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THE

CHEMIST:

A

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OF

CHEMICAL PHILOSOPHY,

AND OF

CHEMISTRY APPLIED TO THE ARTS, MANUFACTURES, AGRICULTURE, AND MEDICINE,

AND

RECORD OF PHARMACY.

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON THE AMORPHOUS STATE OF PHOSPHORUS.*

BY M. A. SCHRÖTTER.

In my memoir on the amorphous state of phosphorus, I made known the conditions in which ordinary phosphorus, that is to say, crystallised phosphorus, passes to the amorphous state, as well as the physical properties of this body when it is in the latter state, and the remarkable manner in which it behaves with regard to other bodies. The accuracy of my observations and conclusions has raised many doubts, as well on account of the extreme resemblance between the amorphous phosphorus and the combination known under the name of oxide of phosphorus, as on account of the striking difference which exists between the properties of these two modifications of phosphorus and the manner in which they act. These doubts surprised me so much the less as I regarded my own observations with extreme mistrust, seeing that indisputable facts had not demonstrated that the body which I had obtained was not indeed a new combination of phosphorus, but phosphorus itself under a new form. Dumas was the first who acknowledged, at the sitting of the Academy of Sciences of October 23, 1848, and in his course at the Sorbonne, the accuracy of my experiments and of the conclusions which I deduced from them. At the same time, my experiments were repeated in Liebig's laboratory, and with the same results. In England, where my work was made known soon after my arrival, I had an opportunity of making my experiments in the presence of Messrs. Faraday, Graham, Hofmann, Muller, Percy, &c.; and when, as I have reason to hope, this body shall have become an ordinary article of commerce, no one will be able to doubt the accuracy of my discovery.

I have not hitherto been able to obtain this modification of phosphorus under any other form than that of a fine powder and of a red color varying from light to dark, according to its degree of tenuity. In the numerous changes to which I submitted the treatment of this body, I have obtained it sometimes, as stated in my first work, under the form of hard crusts, differing little, however, from phosphorus in powder, and presenting only, at the parts where it has been in contact with the glass, a more brilliant vitreous lustre. This phenomenon, which is evidently the effect of this contact, cannot, for this reason, be owing to the nature of the amorphous phosphorus. However, this circumstance, that the crusts affect a deeper color than phosphorus in powder, led me to try some experiments with the view of determining the nature of these crusts. For this purpose, I exposed ordinary phosphorus to a temperature which was as near as possible that at which they were transformed *de novo*, and at the end of a long time, about eight days, I obtained it in the state which I am about to describe having undergone only the slightest of the changes which it could undergo.

I had judged that if we could ever obtain amorphous phosphorus, it would very probably be by this way. My expectation was not deceived; for, which was worthy of remark, the phosphorus, at the end of the experiment, passed to the state of a perfectly coherent mass, of a red brown, presenting

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* *Comptes Rendus de l'Académie des Sciences*, No. 5, July 29, 1850.

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in its fractures an imperfect and black metallic lustre. This brittle mass has perfectly conchoïdal fractures. These fractures are irregular, and present sharp angles and fine edges. The interior of the mass affects the same red color as powdered phosphorus, so that in this respect, the resemblance between the physical properties, apart from the fibrous arrangement, and that of a rhombohedral variety of plumbago, hœmatite, is almost complete.

The hardness of coherent amorphous phosphorus is very considerable: it is about 3·5, and is consequently the medium between that of calcareous spar and fluor spar. Its density, at 62° F., is 2·089, which is precisely the same as that found by Boettger for ordinary phosphorus. But this can only be an accidental coincidence, for I have every reason to believe that the cypher of this density, although certainly very accurate in itself, does not, however, represent the real density of amorphous phosphorus. The pieces which I have in my hands still contain a mixture of 0·2 to 0·3 per cent. of ordinary phosphorus, a circumstance which must necessarily modify its true density. And, indeed, pieces of amorphous phosphorus, which had been subjected to the influence of heat for a still longer time, and which contained, therefore, still less ordinary phosphorus, presented, at the temperature of 62° F., a density of 2·106.

In my first memoir, to prove that phosphorus, modified by light or heat, becomes amorphous, I relied only on this powder presenting the same appearance to the naked eye and to a microscope of the greatest magnifying power. But, this state of coherent mass brings a complete confirmation to my ideas, for this body does not present, in its fracture, the slightest trace of crystallisation, and it does not present any of the properties which have been hitherto observed in crystallised bodies; whence it must be concluded that it is amorphous. We possess, now, therefore, an octohedral phosphorus and an amorphous phosphorus, the same, to mention only one analogous example, as we have an octohedral carbon and an amorphous carbon, without reckoning the rhombohedral.

It is scarcely necessary to add that the coherent amorphous phosphorus, so far at least as I have been able to prove, acts chemically the same as phosphorus in powder. I should, however, observe that the small proportion of ordinary phosphorus which is mixed with it, gives rise to some phenomena which must be taken into account, otherwise errors would easily arise. It frequently happens that when a piece of coherent phosphorus is broken, it inflames, and the combustion, accompanied by a red light, continues slowly, and gradually causes the rupture of the mass; it may easily be extinguished with water. If this mass be pulverised under water and if the powder which has been freed from the greater part of its water, by means of filtering paper, be allowed to remain in the air, an acid reaction soon takes place, the water is absorbed, which also takes place, but more slowly, when the powder has been well dried. When this powder is heated, it inflames even before the temperature reaches 212° F. It is luminous in the dark, and combines with chlorine with flame. These phenomena are not dne, as I have already shown, to the amorphous phosphorus, but to the ordinary phosphorus which is mixed with it. Facts might induce us to believe, but erroneously, that amorphous phosphorus slowly returns to the state of ordinary phosphorus; but it is not so, or, at least, this has not been observed during the space of three years and a half. I have on my table a filter covered with amorphous phosphorus which is reduced to extremely small pieces, and which has been left thus for more than a year to the influence of the air. I wet it occasionally; it dries; still the phosphorus does not give rise to an acid reaction nor to any odor. This powder might be taken for pulverised oxide of iron.

I should add, in conclusion, that, since the publication of my first work on this subject, I have had an opportunity of obtaining again the most important of the results at which I arrived, partly changing the circumstances, and I found to my great satisfaction, that I had nothing to retract or rectify in the former.

I may add one fact, although it does not quite relate to the subject of this communication. I ascertained by experiment that phosphorus can decompose water, and that it does so at a temperature of 482° to 500° F. If humid phosphorus be put into a tube hermetically closed by fusion at both ends, and exposed for some time to the above-mentioned temperature, we obtain, on breaking the tube, a phosphuretted hydrogen gas, which is mixed with the H^2P of Thenard, and which afterwards inflames of itself. The decomposition of water by phosphorus, under the influence of light, had already been admitted, in order to explain, by the formation of oxide of phosphorus, the red color which it then assumes. Now, it results from the above-mentioned facts that this transformation is not due to the presence of water, but that the latter is really decomposed by phosphorus, at a not very high temperature.

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REPORT ON THE PRESENT STATE OF OUR KNOWLEDGE OF THE CHEMICAL ACTION OF THE SOLAR RADIATIONS.

BY MR. R. HUNT.

In this report the author gave an historical sketch of the progress of inquiry on this subject, from the period when Scheele first observed that the chloride of silver was blackened much more speedily by the rays at the blue end of the spectrum than by those at the least refrangible, or red end, to the announcement of the discovery of the sensibility of the iodized tablets to the solar influences by Daguerre and the discovery of the action of gallic acid in the Calotype process by Mr. Fox Talbot. He then proceeded to show the extent of knowledge we had obtained as to the peculiarities of the phenomena which may be summed up as follows. The chemical action of the sun's is proved, by its influence on organic and inorganic bodies, to extend over all the luminous rays of the prismatic spectrum—and slightly beyond them at the least refrangible end, and considerably beyond them at the most refrangible extremity. Living organisms and the products of organic life appear to be influenced by light—the luminous power—as distinguished from the purely chemical, or calorific, powers. The vitality of plants is stimulated by light; and although many functions are performed in the absence of luminous radiations, they appear to be all quickened by its exciting powers: at the same time we have evidence to show that the chemical principle is necessary to the process of assimilation, and consequently to the production of many of the proximate constituents of plants. The author is of opinion—though he regards the subject as open to serious inquiry—that the process of germination and budding are essentially influenced by the chemical principle *Actinism*:—that the decomposition of carbon is peculiarly due to the luminous principle; and hence that the formation of wood in plants is a function of their vitality excited by *Light*:—that the developement of the flower is due to a delicate balance of the forces *Actinism* and *Light*, since we find that both the luminous and chemical agencies are very active during the process, and that the ripening of fruit and the perfecting of the healthful conditions of the seed are due to a combination of the calorific and chemical forces—as evidenced in the so-called parathermic rays,—many of the properties of which have been examined by Sir John Herschel and Mrs. Somerville. Returning to the consideration of the influence of the solar rays upon inorganic bodies, the author thought it established beyond a doubt—1st, That the maximum of chemical (actinic) phenomena was to be found where there was the least quantity of light and heat.—2, That as the luminous power increased—either in the spectrum or in natural phenomena—the chemical (Actinic power) diminished, until it came to its minimum, where light—luminous power—existed at its maximum.—3rd, That although the chemical influence extended to the red or heat-giving rays, its operations were materially modified, and to all appearance changed, by the combined operation of the calorific power, and that results standing in direct opposition to those obtained by the pure chemical rays were given by the chemico-calorific rays. In conclusion, the author pointed out the wide field for investigation which was opening up to the experimentalist,—and he showed that, although much had been achieved by the experiments already undertaken, there yet remained a most extensive ground for inquiry which may be considered as absolutely unbroken:—chemical action—vital power—electrical phenomena and phosphorescence were proved to be directly dependent on the solar influences; but we yet want the researches which shall satisfactorily show whether these phenomena are due to one great principle modified by the matter on which it acts, or if they result from the operation of forces combined in action, although very different in their resulting effects.

ON A PECULIAR FORM PRODUCED IN A DIAMOND WHEN UNDER THE INFLUENCE OF THE VOLTAIC ARC.

BY J. P. GASSIOT.

M. Jacquelain first showed that when the diamond is submitted to the high temperature and influence of the voltaic arc, it quickly becomes converted into a black carbonaceous matter having all the appearance of coke:—the diamond when in a native state is an insulator or non-conductor of electricity, but when thus changed into coke it becomes an excellent conductor.

At the Chemical Section of the British Association, held at Oxford, in 1847, Dr. Faraday exhibited some specimens of the diamond coke which had been forwarded to him by M. Jacquelain, and subsequently, on the 16th of June, 1848, he publicly showed the experiment in London, in the

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theatre of the Royal Institution. On repeating the experiment a short time since before a few private friends, I obtained a product so totally different from that of M. Jacquelain, that I am induced to bring the subject before this Section, in the anticipation that it may elicit some observations on a phenomenon which at the time attracted the attention of many electricians.

The apparatus I used in the experiment consisted of forty series of the usual size of Grove's nitric acid battery—the terminals were made from two pieces of well burnt box-wood charcoal—that attached to the positive or platinum end of the battery being formed in the shape of a small cup or crucible, in which the diamond was placed; to the negative or zinc end of the battery, a piece of the same charcoal (but *pointed*) was attached. The experiment was then made in the same form as described by M. Jacquelain, by first making contact with the two charcoal terminals, then bringing the flame into such a position as to cause it to *surround* the diamnod;—in less than one minute the diamond as well as the electrode became in a state of intense ignition. The diamond gradually increased in size, rolling about in the heated crucible; when it suddenly expanded, forcing itself upwards on the negative terminal, at which moment I separated the electrodes. The diamond, which was in a state of intense ignition, remained attached to the negative terminal.

When cool it exhibited the same state as it now presents. It was expanded to eight or ten times its original bulk. Instead of becoming a black carbonaceous substance, and a good conductor, it has a vitreous white opaque appearance, and remains a non-conductor. It has also a deep circular cavity on that portion which was opposite and nearest to the positive electrode; that part which was in contact with the negative electrode being clearly discernible by a small portion of the box-wood charcoal remaining attached to it. The centre of the cavity appears to be still brilliant, as if that portion of the diamond had not been in a complete state of fusion. In one or two other experiments the diamonds disintegrated, the fragments remaining in a carbonaceous state; since which I have not had an opportunity of repeating the experiment.

ON THE PROPORTION OF PHOSPHORIC ACID IN SOME NATURAL WATERS.

BY PROFESSOR VÖLCKER.

THE object of this paper was to draw attention to a natural source from which many of our fields may be economically supplied with phosphoric acid. Professor Fownes has shown that traces of phosphoric acid are met with in many rocks of igneous origin, and the presence of phosphoric acid has been indicated by several chemists, in stratified rocks, particularly in limestone rocks.

The author found the proportion of phosphoric acid in graptolite, from the neighborhood of Cirencester, amounting to 0·124 per cent., equal to 0·260 of bone-earth, and in Stonesfield slate from the same locality amounting to 0·117, equal to 0·244 per cent. of bone-earth.

As water, charged with carbonic acid, is capable of dissolving bone-earth, this important fertilizing substance is found in many natural waters, percolating rocks which contain phosphoric acid. Such waters, therefore, may be applied with advantage for irrigation.

The advantages derived from this too often neglected natural source, are strikingly exhibited in the irrigated meadows in the neighbourhood of Cirencester; and it is the opinion of the author that one of the chief causes of the beneficial effects which follow the application of the water for irrigation in this locality, is to be found in the phosphate of lime it contains.

In a tea-kettle incrustation formed in a short period by this water, the proportion of phosphoric acid was found to amount to 1·25 per cent., showing a considerable quantity of this acid present in the water.

A very hard water from Edinburgh likewise proved to contain phosphoric acid, but its proportion was not so large as that in the Cirencester water, the quantity of phosphoric acid in a boiler incrustation formed by this Edinburgh water being only 0·427 per cent.

Sea water also contains phosphoric acid, but the proportion of the latter amounts to mere traces. A quantitative determination of phosphoric acid in the boiler deposit of a Canada steamer gave only 0·0306 per cent., and that in a boiler incrustation of a steamer plying between Dublin and Liverpool 0·0424 as the per-centage of phosphoric acid. In conclusion, the author recommended Swanberg's test, molybdate of ammonia, as a ready means of deducing the presence of phosphoric acid in natural waters.

ON SOME AMALGAMS.

BY J. P. JOULE.

THE author procured an amalgam of iron by precipitating it on mercury by the

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electrotype process. He subsequently pursued the investigation with the view of forming definite amalgams by a simple chemical or mechanical process. When mercury was made negative under a solution of sulphate of copper, an amalgam of copper was formed which, when fully saturated with copper, was found to be represented by the formula Cu+Hg. The author also exhibited a small apparatus whereby amalgams could be made to endure a pressure of sixty tons per square inch of surface. The superfluous mercury was thus expelled through the openings in the sides of the press, leaving an amalgam of definite chemical composition. In this way he had procured the undermentioned compounds:

Pt +	2 Hg
Ag +	2 Hg
Cu +	Hg
Fe +	Hg
2 Zn +	Hg
2 Pb +	Hg
7 Sn +	Hg

CHEMICAL INVESTIGATIONS ON THE EGGS OF THE CARP.*

BY M. GOBLEY.

(Concluded from Vol. I, Page 531.)

CEREBRINE.

I HAVE already stated that I regard the viscid matter of yolk of egg as a soap enveloped by a nitrogenous organic matter which for a long time prevented me from ascertaining its nature. I have likewise said that when the viscid matter is mixed with acids or the mineral alkalis, grey or white pellicles are obtained according as the first or last of these agents are employed. These pellicles form, as I supposed in my first memoir, a nitrogenous organic matter, differing from vitelline, but it does not, as I supposed, contain sulphur. That which I found arose from a small quantity of albuminous substance carried along with it. The pellicles of which I have just spoken constitute the cerebrine: I first proved the presence of this substance by treating the viscid matter with acidulated alcohol; it separates under the form of a white body of a soft consistence, when the oily liquid thus obtained is left to itself.

It is found in the yolk of fowls' eggs, and in those of the carp so intimately united with lecithine, that I have hitherto failed in obtaining it without decomposing the latter. In the eggs of the carp as in the yolk of fowls' eggs, it is found in much smaller quantity than lecithine.

The following experiments were made with that from the yolk of fowls' eggs. To obtain it, take 200 grammes of viscid matter, introduce into a flask with 500 grammes of alcohol, at 88 per cent., and 50 grammes of hydrochloric or sulphuric acid; leave them several hours in contact, then heat them so as to bring the liquid slowly to the boiling point. After boiling up once or twice remove it from the fire, and pour the liquor into a glass with a foot.

In cooling it forms two layers, one oily, the other aqueous; the oily layer occupies at first the inferior portion of the vessel, but as the liquid becomes more dense as it loses the alcohol, it rises to the top of the liquor. After separating it, leave it in a cool place where it will shortly deposit a white substance, of a soft consistence, like caseine. It at the same time deposits cholesterine.

Sometimes the cerebric matter is isolated as soon as the liquid is removed from the fire; it must then be collected, the whole thrown on a filter, and the fixed oil and cholesterine that accompany it separated, by placing it in contact with ether, which dissolves these bodies without removing an appreciable quantity of cerebrine.

To purify the cerebrine separated from the oily liquid, it must be placed on a filter, spread on blotting paper, so as to remove the fatty body with which it is impregnated; it is dissolved in boiling alcohol of 88 degrees, the liquor, from which it is deposited almost entirely on cooling, filtered. This treatment is repeated a great number of times, to separate the acid which has been used, and which is most obstinately retained by the cerebrine. Finally the cholesterine which accompanies it is separated by means of ether, and it is dissolved in boiling alcohol. While depositing, it appears under the form of small crystalline grains, but which agglomerate in drying, so as to present no regular form; the cerebrine is likewise often in small plates much resembling white wax in appearance and consistence.

When the cerebrine is separated immediately from the alcoholic liquor, it is treated with boiling alcohol, after having, however, separated, by means of ether, the fatty matter and cholesterine; it is then observed that only a very small quantity is dissolved in this liquid, as a very large quantity of alcohol must be employed for dissolving even a very minute quantity of this substance. It dissolves, however, very

*Journal de Pharmacie, August, 1850.

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readily in absolute alcohol; thus obtained, it is under the form of very light, white leaves.

Cerebrine, prepared by either means, still retains some phosphate of lime, with which it appears to be very intimately united. To separate it, it must be dissolved several times in absolute alcohol, and the liquor filtered each time: the alcoholic treatments must be repeated until the paper no longer retains any foreign substances.

The cerebric matter, in separating from the alcoholic liquid, occupies, as we have already stated, a considerable volume; therefore, to collect it, the whole must be thrown on a filter; it is afterwards compressed, and it is removed before it has become quite dry. Without this precaution, it would adhere to the paper, and it might be very difficult to detach it from it. The desiccation is finished, either in the open air, or in a moderately heated oven, for this substance, when it is hydrated, enters into fusion at a rather low temperature.

Cerebrine may, therefore, be obtained under several forms; in very light leaves, in small plates, resembling white wax in consistence and appearance, or under the form of small, crystalline grains, when it is dried without pressure.

Cerebrine, as I have obtained it, is solid, colorless, inodorous and insipid. Is it an acid or a neutral body? This question it is very important to solve. When we hydrate cerebrine by heating it with water, that which is separated immediately from the alcoholic liquor, exerts no action on litmus paper; that which is separated from the oily liquid exerts on that vegetable color a very slightly acid reaction. To obtain the rose coloration, the cerebrine must be put in a jelly on light blue litmus paper, and the latter placed in a moderately heated oven. The viscid matter does not exert, as I have said, any action on litmus, and it does not contain any base with which it might be supposed that the bodies of which it is composed could be combined; the very slight acidity which cerebrine presents can, therefore, have been communicated to it only by the treatments which it has been made to undergo, or be due to traces of the acid which has been used for separating it.

To ascertain if it retained any of the acid employed, I burned a certain quantity of it with very pure nitrate and carbonate of potassa, and I found in the solution of the product of the calcination traces of chlorine. Cerebrine, prepared by means of sulphuric acid, also retained traces of that acid. The liquor acidulated with nitric acid did not appear at first to be rendered turbid by chloride of barium, but, by repose, a slight deposit of sulphate of baryta was formed.

Thus cerebrine is neutral in the yolk of the egg, and the very slight rose coloration which it communicates to litmus is evidently due to its retaining an infinitesimal quantity of the acid with which it has been prepared.

Submitted to the action of heat, when it is deprived of all moisture, it fuses between 311° and 320° F.: its point of fusion is therefore higher than that of cholesterine. Above the temperature of 320° F. it soon assumes a brownish tint and decomposes. When it retains water or a little fatty matter, cerebrine enters into fusion at a lower temperature. Heated in a glass tube, it furnishes ammoniacal products; calcined in a platinum capsule, it gives a charcoal which burns difficultly, and which did not appear to me sensibly acid; calcined more powerfully, it always left a slight residue of phosphate of lime.

Neither cold nor boiling water dissolve it; but in these liquids, and more particularly in the latter, it swells up like starch and communicates to it the property of frothing like soapy water. Lecithine likewise possesses this latter property; it is this, doubtless, which has contributed to cause these bodies to be regarded as saponaceous compounds. It dissolves in alcohol only when it is boiling, and it separates almost entirely on cooling, occupying a considerable volume, and under the form of small crystalline grains. Ether exerts no sensible action on it; hydrochloric acid does not color it blue. It does not contain sulphur.

It combines with acids and retains them with great obstinacy; that which has undergone the influence of these agents, always contains traces of them.

It combines with the metallic oxides, but there is no regularity in the quantities of oxide which cerebrine can retain. I made my experiments with potassa-alcohol, and I ascertained that the quantity of potassa thus removed by the cerebrine varied according to the proportion of cerebric matter employed, according to the temperature at which the operation was performed, and according to the number of washings with alcohol which the precipitates obtained in this manner were made to undergo. Cerebrine possesses therefore a certain affinity for bases, but it does not form with these bodies what we call salts, that is to say, compounds in definite proportions.

We cannot, however, be surprised at these singular properties to which there is

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nothing analogous in inorganic chemistry. Substances which have already been studied, such as fibrine, albumen, &c., act, in similar circumstances, like lecithine and cerebrine, which, it appears to me should be ranked among them.

I submitted the cerebrine of the yolk of the egg to analysis: the following are the results which I obtained:—

0·425 gr. of substance dried at 248° F., furnished 0·414 gr. of water and 1·042 gr. of carbonic acid.

0·410 gr. of cerebrine gave 8 cubic centimetres of nitrogen at 59° F., and 0·764 mm pressure, the humid gas.

0·549 gr. of the same substance, burned by means of nitre and carbonate of potassa, furnished 0·17 gr. of phosphate of baryta, which corresponds to 0·43 per cent. of phosphorus.

We have, therefore, in hundredths:—

Carbon	66·85
Hydrogen	10·82
Nitrogen	2·29
Phosphorus	0·43
Oxygen	19·61
	100·00

The following are the compositions of cerebric acid obtained by M. Fremy and Dr. R. D. Thompson:—

	Fremy.	Thompson.
Carbon	66·7	67·04
Hydrogen	10·6	10·85
Nitrogen	2·3	2·24
Phosphorus	0·9	0·46
Oxygen	19·5	19·41
	100·0	100·00

Everything tends to show that these two bodies are identical.

The foregoing experiments were made, as I have said, with the cerebrine of the yolk of the fowls' egg: I should doubtless have obtained similar results with that of the eggs of the carp, if I had operated on sufficiently large masses to obtain enough for the purpose.

Lecithine and cerebrine always retain, notwithstanding a very great number of treatments with alcohol or ether, a certain quantity of earthy phosphates: they probably aid, as well as the albuminous matter, in putting these salts in circulation in animals, and in dissolving them, so to speak, they disguise their properties. We should not be astonished at these facts, when we consider that albumen with a large proportion of alkali contains a large quantity of phosphate of lime whose presence under the soluble form seems incompatible with that of the alkalis. This is one more proof that these bodies do not obey all the laws which govern mineral products and the majority of organic compounds.

Lecithine and cerebrine are, like albumen, fibrine, cholesterine, &c., &c., elements of our organisation. The substances are modified *ad infinitum* in the animal economy, and affect very different physical states, but they will always be recognised, the first in the products of decomposition which it gives (oleïc, margaric and phosphoglyceric acids); the second, because it swells up in water like starch, and because it contains nitrogen.

OLEÏNE AND MARGARINE.

When the fatty matter of the eggs of the carp obtained by means of ether is treated with boiling alcohol, there remains attached to the sides of the flask a fatty matter which is almost entirely formed of fixed oil.

When a certain quantity of this substance has been collected, it is first washed with boiling alcohol and then dissolved in ether; the liquid filtered and evaporated gives an oil of a reddish color.

This fatty matter contains neither sulphur nor phosphorus. I arrived at a knowledge of its nature by analysing the products of its saponification by means of caustic potassa, as I had done for the fixed substance of the fowls' egg. The liquid fatty acid possessed the properties of oleïc acid. The melting point of the solid fatty matter was 140° F.; it crystallised in alcohol in the same manner as margaric acid, and it presented all its properties.

I obtained too small a quantity of these bodies for analysis.

I will make one observation in conclusion. In my researches on the yolk of the egg, I stated that the oil of the egg was formed only of oleïne and margarine, because by saponifying it I obtained only oleïc and margaric acids. Kodweiss has announced that he extracted from it steäric acid.* I have not been able to procure this chemist's memoir, nor, consequently to make myself acquainted with the detail of his experiments: I know not whether he saponified the oil obtained by pressure, or that procured by means of ether and containing cholesterine, or an oil freed from that substance as I have done. It is very well known that cholesterine augments the fusing point of margaric acid and may cause it to be mistaken for steäric; I am enabled to affirm, and I have repeated my experiments with this regard, that by operating on oil of the egg completely deprived of cholesterine by means of boiling alcohol (a long

* *Revue Scientifique*, Jan., 1847.

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and delicate operation), I have not been able to prepare an acid fusible above 140° F. Moreover, it is only after treating a very great number of times by alcohol that I have been able to obtain even this point of fusion.

ACID OF THE EGGS OF THE CARP.

Turmeric paper and reddened litmus paper do not change color when put in contact with the substance contained in the eggs of the carp; blue litmus paper appears to acquire a slight rose tint. The eggs of the carp, like the yolk of the fowls' egg, would, therefore, appear to be neutral or very slightly acid.

When the eggs of the carp are boiled in water, an acid liquor is obtained which becomes more acid when reduced to a smaller bulk, and with the addition of alcohol. The experiments which I have made prove that this acidity is due to an organic acid which appears to me to present the reactions of that which the yolk of the fowls' egg furnishes in the same circumstances. However, I must mention that on putting it in contact with oxide of copper, the filtered liquor did not present that evident blue coloration which, according to M. Pelouze, characterises lactic acid. Although it is probable that the acid furnished by the eggs of the carp is of the same nature as that extracted from the yolk of the fowls' egg, still I cannot, from this experiment, admit that there is any identity between the two bodies. However, I may be permitted to say that if this body is not lactic acid, it greatly resembles it in its properties.

Does the organic acid which is found in the liquid resulting from boiling in water the yolk of the fowls' egg or the eggs of the carp exist in these bodies, or is it a product of decomposition? An experiment made on an analogous body made me doubtful in this respect.

The soft roe of the carp exerts no action on litmus, and yet, by boiling in water, it furnishes an acid liquor which possesses the properties of that which is obtained with the yolk of the fowls' egg and the eggs of the carp. It cannot be admitted, in this case, that the acid pre-exists, and we are led to believe that it is a product of decomposition. Is it the same with the yolk of the fowls' egg and the eggs of fish? Does the reddish-yellow coloration of these substances lead to error? I am not at present in a condition to decide this absolutely.

OF THE SALTS CONTAINED IN THE EGGS OF THE CARP.

The process which I followed for obtaining the salts of the yolk of the fowls' egg succeeded perfectly for isolating those of the carp. The following are the results which I obtained in 100 parts:—

Chlorides of sodium and potassium	0·447
Sulphate of potassa	0·012
Phosphate of potassa	0·025
Hydrochlorate of ammonia	0·042
Phosphates of lime and magnesia	0·292
	0 818

The eggs of the carp contain, therefore, more soluble salts and less of earthy phosphates than the yolk of the fowls' egg. Is not this composition in proportion to the different organisation of the skeleton?

COLORING MATTER.

The fatty matter of the eggs of the carp presents the reddish-yellow coloration of that of the fowls' egg, and its color is likewise due to the reunion of the yellow and red coloring principles.

I obtained the coloring matter of the yolk of the fowls' egg by treating the oil of the egg treated several times with boiling alcohol. I found it impossible to separate that of the eggs of fish by this means, for the fixed oil is, as we have said, in very minute proportion in the latter. I was enabled to isolate it by putting the fatty matter of the eggs of the carp into the same conditions as that of the yolk of the fowls' egg. I agitated it in a flask with oil of bitter almonds, and I threw the whole on a filter; the oily liquid which flowed out had the color of the oil of the egg; it contained no phosphate and yielded to boiling alcohol coloring matter, cholesterine and a small quantity of oleïne. The alcoholic liquor left by evaporation a reddish residue soluble in alcohol, to which it communicated a very powerful red tint. On dissolving and crystallising the cholesterine which separated from the alcoholic liquor, and evaporating the liquid, a new residue in which the yellow tint predominated was obtained. The red coloring matter appears, therefore to be more soluble than the yellow.

These coloring principles are, like those of the yolk of egg, in solution in an oily liquid which always retains a little cholesterine; the mixture of these substances is much more soluble in alcohol than oleïne.

When the alcoholic liquid containing in solution the red coloring matter is evaporated to dryness, a reddish matter which contains iron remains. Indeed, this residue, heated with pure concentrated sulphuric acid, until no more white vapors are disengaged, gives a charcoal which, treated with distilled water, furnishes a liquor which is colored red by sulphocyanide of potassium; the yellow prussiate determines in it a slight blue precipitate.

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In speaking of the albuminous matter, I have said that, after having been treated by alcohol and ether, it possesses a very decided red tint. To ascertain whether this color was due to the presence of iron, I put this substance in contact with concentrated hydrochloric acid; after twenty-four hours, I decanted and drove off the excess of acid: the residue, diluted with distilled water, took a blood-red color with sulphocyanide of potassium; consequently, it contained iron.

ODOROUS PRINCIPLE.

During the course of my researches on the eggs of the carp, a peculiar odor, resembling that of fish, was exhaled. I proved by the following experiments that the odorous matter of these eggs does not possess acid properties.

I at first submitted to distillation 200 grammes of the eggs of the carp divided in distilled water; the product, which had a very decided fishy odor, exerted no action on litmus paper, and left no residue by evaporation.

I afterwards distilled the same quantity of the eggs which I had previously crushed with great care, and mixed with dilute sulphuric acid. The liquid which distilled over presented the odor which was disengaged during my experiments, but it exerted no action on the vegetable colors, had no perceptible taste, and left no residue by evaporation.

CONCLUSIONS.

From the foregoing experiments, I think I may conclude:—

1. That the eggs of the carp present the greatest analogy, as regards composition, with the yolk of the fowls' egg:

2. That they appear not to contain an alkaline albumen similar to that which envelopes the ordinary yolk of egg:

3. That they contain more than half their weight of water:

4. That the albuminous matter or paravitelline possesses the composition and properties of vitelline:

5. That the fatty substance is formed, like that of yolk of egg, of two distinct parts—of a fixed oil and of a soft, insoluble substance, or viscid matter:

6. That the fixed oil which is found in very small quantity is formed, like that of the yolk of the egg, of oleïne and margarine; that it contains neither sulphur nor phosphorus:

7. That the viscid matter which forms of itself almost the whole of the fatty substance of the eggs of the carp constitutes a complex body, containing phosphorus, from which I extracted cholesterine and two peculiar substances which I noticed in yolk of the fowls' egg, and which I designate, the first under the name of lecithine, and the second under the name of cerebrine:

8. That the cholesterine is identical, as regards composition and properties, with that of the yolk of egg and biliary calculi:

9. That lecithine is the phosphuretted substance of the yolk of the fowls' egg and of the eggs of the carp; that it constitutes a neutral body which always gave me with the greatest facility, as products of decomposition, in presence of the mineral acids and alkalis, under the influence of water and under that of alcohol, and without the intervention of the oxygen of the air, oleïc, margaric and phosphoglyceric acids:

10. That cerebrine is a neutral body, which contains nitrogen, fuses at a high temperature, and swells in water like starch:

11. That by boiling the eggs of the carp in water, an acid liquid is obtained, which becomes more acid by the addition of alcohol; that this property is due to lactic acid or to an acid which closely resembles it in its properties:

12. That the eggs of the carp contain the salts which I found in yolk of egg, and which exist in the animal economy: chloride of sodium, chloride of potassium, hydrochlorate of ammonia, sulphate of potassa, and phosphates of potassa, lime and magnesia; that they contain besides a considerable quantity of that indefinite substance to which Berzelius gave the name of extract of meat or alcoholic extract:

13. That the coloring matter of the eggs of the carp appears to be formed, like that of yolk of egg, of two coloring principles, one red, which contains iron, and which is analogous to the coloring matter of the blood, and the other yellow, which may be analogous to the yellow coloring matter of the blood or of the bile:

14. That the average composition of the eggs of the carp is, in 100 parts:—

Water	64·080
Paravitelline	14·060
Oleïne and margarine	2·574
Cholesterine	0·266
Lecithine	3·045
Cerebrine	0·205
Hydrochlorate of ammonia	0·042
Chlorides of sodium & potassium	0·447
Sulphate & phosphate of potassa	0·037
Phosphate of lime and magnesia	0·292
Extract of meat	0·389
Membranes and envelopes	14·530
Coloring matter, traces of iron, &c. &c.	0·033
	100·000

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The composition of the yolk of the fowls' egg is:—

Water	51·486
Vitelline	15·760
Margarine and oleïne	21·304
Cholesterine	0·438
Lecithine	8·426
Cerebrine	0·300
Hydrochlorate of ammonia	0·034
Chlorides of sodium and potassium, and sulphate of potassa	0·277
Phosphates of lime and magnesia	1·022
Extract of meat	0·400
Coloring matter, traces of iron, &c. &c.	0·553
	100·000

Such are the results which I obtained in the researches which I have made on the eggs of the carp; they lead us, as may be perceived, to regard fishes' eggs as containing the same elements as those of birds. The principles which constitute the eggs of these two classes of animals vary, it is true, in their relative proportion, but that is probably owing to their being developed in different media.

The eggs of fish, as is known, are fecund only after laying; consequently, the principles which they contain are not the product of fecundation. Does this physiological act change their chemical composition? It appeared to me that this interesting study should be preceded by the examination of the soft roe itself, a necessary agent of fecundation. I will in my next memoir make known the result of my researches on the nature of this substance.

ON THE PER-CENTAGE OF NITROGEN AS AN INDEX TO THE NUTRITIVE VALUE OF FOOD.

BY DR. A. VÖLCKER.

THE purpose of this paper was to show that the usual estimation of the nutritive qualities of an article of food is frequently attended with inaccuracies, consequently it is desirable to modify our present methods in this respect in many cases.

One circumstance which leads to considerable error is, the presence of ammoniacal salts in the juices of plants. In order to prove experimentally the presence of ammoniacal salts in larger quantities than hitherto suspected, and to avoid the objection that they might result from a partial decomposition of albuminous substances, during the analysis, the author selected fungi for his experiments, which are rich in nitrogen and known as being highly nutritious. The species used was *Agaricus prunellus*, a species which is edible, and remarkable for forming most beautiful fairy rings.

After having separated all soluble protein compounds by means of basic acetate of lead, which throws them down completely, the amount of nitrogen remaining in the juice of these agarics, in the form of ammoniacal salts, was found to be 0·204 per cent. for the fresh fungi, or 1·820 per cent. for the dried fungi. The whole amount of nitrogen in the same agarics, collected at the same time, determined by combustion, was found to be 0·740 per cent. for the fresh fungi, or 6·610 per cent. for the fungi dried at 212° F. Deducting from the last stated numbers the quantity of nitrogen found to exist in the juice in the form of ammonia, we find that only 0·536 per cent. of nitrogen in the fresh, or 4·799 per cent. of nitrogen in the dry fungi, exists in the state of protein compounds, and that nearly one-third of the nitrogen obtained by direct combustion exists in the form of ammonia in the juice, or at all events in a form in which the nitrogen adds nothing to the nutritive value of the fungi. The nutritive value of fungi has, therefore, been considerably overrated; and there can be little doubt that the same is the case with many vegetables, which, according to the author's experiments, contain sometimes considerable quantities of ammonia in the form of ammoniacal salts.

Dr. CHRISTISON remarked that he had long been convinced that there was a considerable fallacy in the methods of determining the value of nitrogen, and he hoped Dr. Völcker's communication would lead inquiry into a more satisfactory direction.

Dr. DAUBENY made some observations on this paper; and particularly noticed the researches of Prof. Hoffman on the substitution of ammonia, or of its elements, for carbon, which it appeared to him pointed to some laws in connexion with the processes of assimilation of nitrogenous materials by growing vegetables.

Dr. R. D. THOMSON offered some objections to the reception of the doctrine that nitrogen was the principal source of nutrition, since it is found that blood and the other animal constituents contain many other substances.

Dr. L. PLAYFAIR was pleased that Dr. Völcker had pointed out a source of error in the determination of nitrogen. Having been engaged in examining the dietaries of a great number of extensive establishments, he should lay the results before the Meeting.

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REMARKS ON SOME CHEMICAL FACTS CONNECTED WITH THE TESSELLATED PAVEMENTS DISCOVERED AT CIRENCESTER (THE ROMAN CORINIUM).

BY PROFESSOR BUCKMAN.

In this paper it was shown that the materials of which pavements are composed are of two kinds:—the first derived from rocks of the district and termed natural, the second composed of clay, fictilia and glass, artificial tessellæ.

The natural tessellæ, many of which are so altered by chemical manipulation as to cause many of them to be referred to foreign rocks, consist of bits of stone from the chalk, oolite, lias, and red sandstone formations, were clearly referred to their origin, and the processes by which they were prepared for pavements were pointed out. Thus, a grey color was produced from a cream-colored oolite, the change of color being caused by a process of roasting. This is dependent upon the fact that the oolite bed of which they are made contains iron and organic matter, the latter of which prevented the iron from peroxidising, and thus the grey was due to a protoxide of that metal.

The artificial tessellæ from pottery consist of shades of red and black; all the reds being due to a peroxidation of the iron in the clays from which they were made, whilst the blacks were the result of baking in "smother furnaces," as long since pointed out by Mr. Artis, so that the carbonaceous matter of the fuel with which the baking was effected was prevented from escaping, and, as he would lead us to infer, the black smoke penetrates the clay and thus blackens it. The author, however, showed that this smoke acted chemically, by preventing the oxidation of the iron, and thus the change from the dark color of the clay to red which usually occurs in burning pottery and bricks was prevented.

Reference was then made to a medallion of the pavement representing Flora, in the first drawing of which the head-dress and flowers held in the hand were colored verdigris green, the hue these objects presented on being exhumed; but as this was unsatisfactory in chromatic arrangement, the author suspected some subsequent chemical change, and on scraping away the green from the surfaces of the tessellæ in question, a beautiful ruby glass presented itself. New drawings (which were also exhibited) were then made with ruby instead of green color: the result of which was, that what was before inharmonious in color and grouping at once assumed harmony in these respects, and became perfectly intelligible.

An analysis of the glass, made by Prof. Voelcker, showed the cause of change from ruby to green to have been due to the fact that the antique ruby glass had derived its color from peroxide of copper, and that the tessellæ had become covered with carbonate of copper from a decomposition of their surfaces.

NOTE ON HYPOCHLOROUS ACID AND ON THE CHLORIDES OF SULPHUR.*

BY M. E. MILLON.

By keeping chlorine water in flasks sheltered from the light it is preserved without appreciable change; but, if this water be exposed for some time to the direct influence of the solar rays, new reactions are discovered in it. Thus, chloride of lead is converted into pure oxide, and chloride of manganese gives a black precipitate of the peroxide, whilst recent chlorine water does not affect these two chlorides in any way.

In seeking to what chloruretted combination this characteristic oxidation of the chlorides of lead and manganese belonged, I found that it resided exclusively in hypochlorous acid: this acid, ClO, may be thus recognised even in a solution of chlorine, and in very small quantity; for these two reagents, and especially the chloride of manganese, are exceedingly sensitive.

The action of chlorine on water is evidently identical with that of chlorine on moist hydrogenous substances; it is substituted for the hydrogen of the water, and if the phenomenon is limited, it is because the hydrochloric acid in its turn destroys the hypochlorous acid, and regenerates chlorine: this reaction is represented by reversing the two members of the equation—

$$2Cl+HO=ClO+HCl;$$
$$ClO+HCl=2Cl+HO.$$

The hydrochloric and hyponitrous acids can coexist only in presence of a very large quantity of water; I made a direct experiment on this point.

I think that the very simple molecular relation which exists between water and hypochlorous acid should be extended to the chloride of sulphur which figures in this system, sulphurrtted hydrogen in which chlorine has replaced the hydrogen, equivalent for equivalent. It may be conceived, by this arrangement, that the most chloruretted chloride of sulphur will contain 2 equal equivalents of chlorine and sulphur. Thus we seek in vain, as all chemists well

* *Annales de Chimie et de Physique*, August, 1850.

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know to unite more than 1 equivalent of chlorine to 1 equivalent of sulphur; it is, on the contrary, easy to combine several equivalents of sulphur with 1 equivalent of chlorine. This corresponds with the polysulphurets of hydrogen: so that we have the following symmetries:—

HO, HS, HS*n*;
ClO, ClS, ClS*n*.

ON A REAGENT FOR THE PROTEIN COMPOUNDS.*

BY M. E. MILLON.

THE very acid liquor which is obtained by dissolving mercury in its own weight of nitric acid with 4½ equivalents of water, is a reagent of extreme delicacy for all the albuminoïd substances, and for many of the secondary products connected with them.

This nitro-mercurial liquor communicates to these different substances a very intense red color, and we may thus very easily detect in water $\frac{1}{10000}$ of albumen, and even a smaller proportion.

To give an immediate idea of the delicacy of this reagent, and perhaps also of the advantages which may be derived from it in the study of vegetable organisms, I may state that cotton, the feculas and gum arabic, take, on contact with it, a very distinct rose tint. Almost all urines take a rose color, after the nitro-mercurial liquor has been mixed with it, when the mixture is heated and the urea destroyed.

The albumen of the blood, that of serous tumors and of vegetables, fibrine, caseum, gluten, legumine, silk, wool, feathers, horn, the epidermis, gelatine, choudrine, protein, the crystalline lens, the cornea, well-washed crassamentum, and the soluble product which it yields to boiling water as well as its insoluble portion, assume a more or less deep red.

When protein becomes soluble by the prolonged action of alkaline leys, or by the action of sulphuric acid, the same red coloration is always produced; but it is not an insoluble matter which is obtained; the liquor reddens powerfully without giving any precipitate.

Xanthoproteïc acid, the chlorites of protein and the oxides of protein which are derived from these chlorites, are separated from the foregoing products: they do not acquire a red color.

Thus crassamentum is not identical with the oxides of protein obtained by making potassa act on the chlorites of protein. This reagent reveals to us differences which are very interesting to investigate. I have already ascertained that the action of chlorine on albumen, until the gas ceases to be absorbed, furnishes no less than three matters very distinct from each other.

The nitro-mercurial liquor is prepared by pouring on the pure metal an equal weight of nitric acid with 4½ equivalents of water.

The reaction takes place vividly without heat; when it becomes slow, it is very gently heated until the metal is completely dissolved; at this point we stop, and add two volumes of water to each volume of mercurial solution. After some hours, the liquid portion is decanted from the crystalline mixture of the nitrate and nitrite of mercury. This liquor reacts without heat on the albuminoïd substances, but the reaction is complete only at from 140° to 158° F.; it is even good to carry the mixture immediately to ebullition. A prolonged contact of an excess of reagent does not alter the red matter. I have thus kept, for more than a year, albumen turned of a very bright red in presence of a great excess of nitromercurial liquor.

It is to be observed that the reagent resides in neither the protonitrate of mercury, nor in the pernitrate of mercury, nor in their mixture. Nitrous acid must be added to the solution of these two salts; until this is done no coloration is obtained. Pure pernitrate of mercury, saturated with nitrous acid, reddens sensibly, but much less than the mixture of mercurial salts, saturated with the nitrous acid. Thus the most simple method of preparing this liquor consists in treating mercury by nitric acid according to the directions above given.

* *Annales de Chimie et de Physique*, August, 1850.

ON THE ACTION OF THE SOAP TEST ON WATER CONTAINING A SALT OF MAGNESIA ONLY, AND LIKEWISE ON WATER CONTAINING A SALT OF MAGNESIA AND A SALT OF LIME.

BY MR. D. CAMPBELL

THIS was an examination of the value of the soap test of Dr. Clark. The conclusions arrived at were:—

1st. That water containing sulphate of magnesia alone, acts towards the soap test in producing with it a perfect lather, similarly, or nearly so, as does water containing a lime salt alone—but only when the equivalent of magnesia salt does not exceed six grains of carbonate of lime in a gallon of water.

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2nd. That the degrees of hardness of an ordinary water cannot be inferred by the rule. Compute the grains of lime, magnesia, oxides of iron and alumina, in a gallon of water, each into its equivalent of chalk. The sum of these equivalents will be the hardness of the water.

3rd. That the degrees of hardness of a water containing magnesia and lime salts, as shown by the soap test as it is now applied, cannot in every case be taken as representing the amount of these salts in the water; nor in nearly any instance can it be considered as giving the amount of lime in a water when magnesia is present.

4th. That water might show by the soap test a small degree of hardness in comparison to the considerable quantities of salts of magnesia and of lime it might contain, and trusting to this method of analysis alone when selecting water for ordinary use and for steam purposes, might lead to a water being adopted which might not be conducive to the general health, and which would leave considerable deposits in vessels in which it was boiled—a great deterioration to its use in steam generating.

PRESENCE OF FLUORINE IN BLOOD AND MILK.

BY DR. G. WILSON.

In 1846 I announced to the Royal Society of Edinburgh that after finding that fluor spar was soluble in water, and occurred in many natural waters, I thought it well to seek for it in milk and in blood, and found distinct evidence of its presence in both. The proofs were not so decisive as I could have desired. This summer, however, I have employed the fresh drawn blood of the ox. About 26 imperial pints or 3 gallons of blood were made use of. From the large scale on which the experiment was conducted, and the simplicity of the process followed, the evidence in favor of the presence of fluorine in the blood of the ox appears unexceptionable; and it cannot be doubted that the blood of other animals will be found to contain the same element. I presume it to be present in the state of fluoride of calcium, and that its amount is very small, but I have not attempted its quantitative determination.

Milk was examined in a similar way, with nine imperial pints of rich milk from a country farm. The vapor which they evolved etched glass distinctly. The ashes of 12 lb. of new skimmed-milk cheese, made this spring, treated in the same way occasioned deep etching of glass. The ashes of four imperial pints of whey treated in the same way have marked glass so as to show the faintest outlines when breathed upon. In all probability the fluoride of calcium is associated with the phosphate of lime, and, when milk is coagulated, separates along with the caseine.

Dr. Wilson also stated that he had repeated the inquiry into the solubility of fluoride of calcium in water, reported to the Association at its Southampton meeting, and with the same result, viz., that 16 fluid ounces, or 7,000 gr. of water, at 60°, dissolve 0·26 gr. of fluor spar.

ON A NEW AND READY PROCESS FOR THE QUANTITATIVE DETERMINATION OF IRON.

BY DR. F. PENNY.

The author recommends the employment of the chromate and bichromate of potassa for the estimation of iron in the common ores of the metal, and especially for the analysis of the clay-band and black-band ironstone of this country.

He was led to the application of these salts in the course of some recent investigations on the materials and products of the manufacture of alum from "alum-shale," in which he was much retarded by the want of a ready method of estimating the oxides of iron. The chromates of potassa give very accurate results, and possess the great advantage that a much larger quantity of material may be operated on than can be conveniently treated by the usual methods. For practical purposes, he says, the bichromate is to be preferred. The process requires no other apparatus than that commonly used for centigrade testing, which is familiar to all persons engaged in chemical pursuits. It may be easily and rapidly executed, occupying only a fraction of the time required for the process of estimating iron by precipitation as the sesquioxide; and it is not interfered with by the presence of alum and phosphates which usually exist in the ore. The method is based on the well-known reciprocal action of chromic acid and protoxide of iron, whereby a transference of oxygen takes place, the protoxide of iron becoming converted into sesquioxide and the chromic acid into sesquioxide of chromium.

PHOSPHORESCENCE OF POTASSIUM.

BY MR. W. PETRIE.

While speculating on the consequences of the dynamical theory of heat, I was led to

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the conclusion that cold potassium *ought* to be found *luminous;* and farther, that it ought to be only about a *tenth part* as *luminous* as *phosphorus.*

On testing this experimentally, with the precautions for sensitive vision which the anticipated feebleness of the light indicated to be necessary, the result was, that on dividing a bit of potassium (which was quite dry, being protected only by a coating of bees' wax), the halves showed two *distinctly luminous sections;* the light being about *a tenth* of that from a similar surface of phosphorus, as far as the eye could make the comparison. The light diminished, naturally, as a protecting coating of oxide was formed, but remained just perceptible to the most sensitive sight, as long as half an hour.

ACTION OF NITRIC ACID ON THE ORGANIC ALKALIS.

BY DR. THOMAS ANDERSON.

In pursuing the investigations on codeïn which I submitted to the Royal Society of Edinburgh, I was led to observe some very remarkable phenomena which result from the action of nitric acid on this substance, and which appear to be common to all the organic bases, to all those, at least, which I have hitherto had an opportunity of examining.

If codeïn be treated with very dilute nitric acid, a substituted base, nitrocodeïn is obtained; if, on the contrary, the acid be of medium concentration, a very violent action takes place, accompanied by a disengagement of nitrous vapors, from which results a solution of an orange color, depositing, when water is added, a resinous acid. If the nitric acid be evaporated by heating on a sand-bath, the new acid is obtained under the form of a yellowish porous mass, readily soluble in alcohol, from which it is reprecipitated by water. I have not yet completed the analysis of this substance; nevertheless the results obtained appear to indicate a formula derived from codeïn by the substitution of NO^4, and the addition of several equivalents of oxygen. If this acid be treated by a dilute solution of caustic potassa, it is dissolved, giving to the liquor a deep red color, and if it be boiled, a volatile base of a very powerful and peculiar odor is disengaged, which base is obtained, by distillation, in the water of the receiver. The liquid which distils over is of an odor at once penetrating and putrid, and disengages white vapors when a rod wetted with hydrochloric acid is held near it; it possesses a very powerful basic reaction. This solution, saturated with hydrochloric acid, and afterwards evaporated on a sand-bath, leaves a very crystalline salt, which readily dissolves in absolute alcohol. Bichloride of platinum, added to this solution, gives rise to a beautiful yellow precipitate. The analysis of this salt gave results corresponding to the formula $C^2H^5NHCl\,PtCl^2$, whence it results that the base is the methylamine of M. Wurtz. I had already established the formation of methylamine by the action of potassa-lime and soda-lime on codeïn in the memoir I have already mentioned. This base appears to be the only product of the action of potassa on the yellow acid, but I have ascertained that the action of potassa-lime on codeïn itself determines the formation not only of methylamine, but also of another base, C^6H^9N, propylamine.* It appears, therefore, that there exists a certain analogy between the action of soda-lime and that which nitric acid and potassa successively exert on this base. I do not dwell on this point at present, but shall return to it in the course of my investigations.

Narcotine forms with nitric acid a great variety of products which depend on the concentration of the acid. If we operate at a low temperature and with a very dilute acid, derived bases are obtained which I have not yet examined; but by the action of a more concentrated acid, a yellow resinous acid is formed. If this acid be treated by a solution of potassa, a volatile base is disengaged, which, with the salt of platinum, gives results corresponding with methylamine.

Morphia and Strychnia, by the same treatment, give volatile bases which I am now engaged in examining.

The action of nitric acid on Piperine is very energetic; vapors of nitrous acid are abundantly disengaged, accompanied by a peculiar odor resembling that of bitter almonds. A brownish resin is formed, one portion of which floats on the surface, and the other remains dissolved in the excess of nitric acid, and from which it may be precipitated by adding water.

By evaporating the excess of acid on a sand-bath, a brown residue is obtained, which dissolves in potassa, with a magnificent blood red color. By boiling, a volatile base of a peculiar and aromatic odor is

* I may observe that my experiments concerning the action of soda-lime on codeïn were made before I had seen the Note of M. Wertheim, published in the No. of the *Annalen der Chemie und Pharmacie* for February, 1850.

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disengaged, forming a very beautiful salt with hydrochloric acid, which crystallises in needles of an inch in length, even in operating with small quantities.

When a mixture of NICOTINE and nitric acid is heated, red vapors are abundantly disengaged; and by adding an excess of potassa, a new volatile base is obtained, which appears to be ethylamine; but my experiments have not yet been sufficiently extended to enable me to speak positively on this subject.

The decomposition of the alkaloïds which I have just described is very remarkable, and appears to throw an important light on the constitution of the organic bases. I propose, consequently, to examine this subject completely, and I hope soon to be enabled to publish the details of my researches on the foregoing bases, as well as on some others with which I am now occupied.

MEMOIR ON THE DEFINITE COMBINATIONS OF IODINE AND PHOSPHORUS.*

BY M. B. CORENWINDER.

THE combinations of iodine and phosphorus are not at present known, since they have not hitherto been obtained in the definite state and in the form of crystals.

There is, however, a process by which these bodies may be prepared in these conditions. It consists in dissolving phosphorus and iodine successively in sulphuret of carbon, and in cooling the liquid. Crystals of iodide of phosphorus are soon deposited, the composition of which depends on the quantities employed.

Thus, by operating on 2 equivalents of iodine and 1 of phosphorus, we obtain prismatic crystals, of large dimensions, of an orange red color, of the composition, as shown by analysis, of I^2Ph. This is protiodide of phosphorous.

This compound fuses at about 230° F., alters in the air, and volatilises at a higher temperature.

It may be employed with advantage for preparing hydriodic acid.

By taking 3 equivalents of iodine and 1 of phosphorus, and by bringing the liquid into concentrated solution, we very soon procure very irregular crystals of a beautiful deep red color, and presenting the appearance of hexagonal plates. In this instance, it is necessary to cool with a mixture of ice and common salt. These crystals, deprived by distillation of all traces of sulphuret of carbon, give a mass capable of crystallising by fusion in very long prisms. This is the deutiodide of phosphorus.

It fuses at about 131° F., decomposes in water, and likewise furnishes hydriodic acid when heated with a small quantity of water.

By operating on quantities in the proportion of 1 equivalent of phosphorus to 1 of iodine, crystals of the protiodide are obtained, and an excess of phosphorus remains in the mother liquor.

With 5 equivalents of iodine and 2 of phosphorus, protiodide crystallises first, and then the deutiodide, which justifies the following equation:—

$$5I+2Ph=I^2Ph+I^3Ph.$$

With 4, and even 5 equivalents of iodine to 1 of phosphorus, iodine is first deposited, and then crystals of the deutiodide I^3Ph.

The employment of sulphuret of carbon as a solvent has enabled me to obtain, under the form of crystals, several other compounds, such as chloride of phosphorus, sulphuret of phosphorus, &c. These will be treated of in a memoir which I shall have the honor of submitting to the Academy at a future period.

* *Comptes Rendus*, No. 6, August 3, 1850.

PRESENCE OF CARBONATES IN BLOOD.

BY PROFESSOR G. I. MULDER, OF UTRECHT.

THE author's intention was to show experimentally that blood contains carbonic acid not merely in solution, but also in chemical combination with bases and organic substances, as globulin, albumen, &c.

OBSERVATIONS ON THE GROWTH OF PLANTS IN ABNORMAL ATMOSPHERES.

BY DR. J. H. GLADSTONE AND MR. G. GLADSTONE.

WHEREAS oxygen is the most important constituent of the atmosphere so far as animal life is concerned, it is on the carbonic acid, ammonia, and aqueous vapor that the vegetable world is eminently dependent.

Do the oxygen and nitrogen of the air play no important part in the process of vegetation? The following preliminary experiments, with a view to the solution of this and similar inquiries, were detailed by the authors:—

A pansy lived for twenty-four days in an atmosphere of hydrogen, containing 5 per

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cent. of carbonic acid; one similarly placed in an atmosphere of common air remained healthy for a longer period. Five onions just commencing to sprout were severally placed in carbonic acid, carbonic oxide, coal-gas, air containing 8 per cent. of light carburetted hydrogen, and ordinary atmospheric air. The germination of the first two was entirely stopped; while the hydrocarbons appeared considerably to accelerate the growth of the vegetable. The plants in each instance lost weight. A pansy in flower, a young stock, and a grass plant were placed in pure nitrogen gas. The former two soon died, but the grass was left growing a month after the commencement of the experiment. Another pansy was placed in a mixture of oxygen and hydrogen gases in the proportion requisite to form water. In order to imitate the balance which exists in nature between animal and vegetable life, some flies were introduced, along with some sugar to serve as their food. The experiment was commenced a fortnight since, and the plant, when last observed, was in good condition. Owing to the low specific gravity of the mixed gases, the flies were unable to mount on the wing, or make the usual buzzing noise; but the substitution of hydrogen for nitrogen in the atmosphere had no marked effect upon their breathing, thus confirming the observations of M. Regnault by an instance drawn from the articulata.

ON A COMPOUND OF IODINE AND CODEINE.

BY T. ANDERSON, M.D.

THE compound of iodine and codeïne which formed the special subject of this communication, is obtained by mixing together alcoholic solutions of equal quantities of codeïne and iodine, and leaving the mixture to spontaneous evaporation, when the new compound is deposited in crystals.

The compound is insoluble in water, sparingly soluble in cold, but readily soluble in boiling alcohol, and it is again deposited in small triangular plates as the solution cools. Its crystalline form has been determined by Professor Haidinger, of Vienna, who finds it to belong to the doubly oblique system. The crystals have a fine diamond lustre and a deep purple color by reflected, and ruby red by transmitted, light. In powder its color is cinnamon brown.

ON THE APPLICATION OF CARBON DEPOSITED ON GAS RETORTS AS THE NEGATIVE PLATE IN THE NITRIC ACID VOLTAIC BATTERY.

BY CHRISTOPHER LEEFE DRESSER, ESQ., OF LEEDS, COMMUNICATED BY THOS. BELL, ESQ., SECRETARY, R.S.*

IN the retorts used for the destructive distillation of coal to form carburetted hydrogen gas for illumination after a certain period a deposit of a carbonaceous nature is formed on the iron, and once commenced, proceeds with great rapidity, accumulating to such an extent as to close up part of the retort, and leave the whole with a coating varying in thickness from that of writing-paper to several inches.

This carbonaceous matter, though a good conductor of heat, is not so good as the iron of the retort, consequently the process of distillation is impeded and the waste of the heating power becomes at length so great as to compel the disuse of the retort.

In many instances the iron of the retort is destroyed for a considerable space, and its place supplied by the carbon long before it is necessary to destroy the retort. From the continuous thickening of the deposit it is evident that the process of deposition once commenced by the iron is continued by the red hot carbon.

The property of red hot carbon to decompose hydrocarbons was proved from the fact of of a common broom having been accidentally thrown into one of the retorts, which when charred by the heat, rapidly decomposed the gas, the carbon of which formed a singularly beautiful deposit on the slender stems of the broom, being deposited like branches of coral, hard, elastic, of considerable length, and very pure.

The substance assumes a variety of forms and appearances, some of them very beautiful. The density and hardness varies also as considerably.

The form of the deposit appears to be either minute scales, like a section of a hollow sphere, or thin layers.

The scales are deposited on each other till the whole takes the form of mammillar protuberances sometimes of great metallic brilliancy, as specimen No. 1, having but little aggregation and easily crumbled betwixt the fingers. This I believe to be pure carbon, though when heated sulphur is driven off, which appears to be mechani-

* From the author, who states that he will be happy to furnish the carbon, or in any way aid any one who may be inclined to repeat his experiments.

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cally mixed and not chemically combined, for heat drives it off, and leaves the scales brilliant and unaltered in appearance.

Specimen No. 2 has the same form as No. 1, but more aggregated.

Specimen No. 3, has the same form, with considerable hardness.

Specimen No. 4 has the same type, but the mammellar protuberances are large and apparently solid, but when exposed to a red heat for an hour, exhibits the same laminar form as the other. This specimen is very beautiful and singular.

Specimen No. 5. The mammellar form appears lost. The carbon has great hardness equal to black marble, and the fracture is stony without any laminæ.

Specimen No. 6, another appearance is presented of great metallic brilliancy, density, and hardness.

Specimen No. 7 is the same form as deposited on the charred broom, in needle-shaped ramifications, and when magnified, is like a string of beads, very hard, elastic, and composed of pure carbon, at least I have been unable to detect any foreign substance, and there is no appearance of sulphur when heated.

Specimens Nos. 3, 4, 5 and 6 contain iron in a metallic state, but varying considerably in different specimens. No. 5 contains the greatest amount.

These forms of carbon will bear the most violent heat with very little waste. In my crucible furnace, urged with a large circular fan, raised far beyond a forge fire, it suffers but little waste, and gives an intense heat. Formed into crucibles by a lump being cut hollow in a lathe, it is most valuable, standing where all others fail.

The forms of this carbon as shewn in Nos. 5 and 6 are what I prefer in the voltaic battery, and may be obtained at any gas works at the most trifling cost, in plates of large size and sufficiently thin to use in the square cells.

The most convenient form, and involving the smallest cost, also preferable in many respects, is to cut the carbon into sticks of about $1\frac{1}{8}$ inch diameter and 7 long, and use them with the nitric acid in round porous cells, the surrounding zinc cylinders being about 3 diameter.

The cutting of the carbon is accomplished with the greatest facility and certainty, by the machine of a marble cutter, at the small cost of $1\frac{1}{2}$d. each, and can easily be obtained from 6 to 18 inches long, and consequently used with much longer porous cells.

The substance has but little porosity, but I prefer having the plates or cylinders about two inches above the top of the porous cell, as they will then remain in action for hours without affecting the connexions.

The only precautions necessary are, after use, to immerse the plates in boiling water for a few minutes, to abstract the acid, also to dry them well before a fire or in a stove, immediately previous to use; if these precautions are neglected the acid will absorb moisture from the air, and be always damp and affect the connexions. Often when in haste I place them on the fire, and sometimes heat them red, which in nowise deteriorates, but rather improves their action.

Having used the same plates and cylinders for a long time, no deterioration of their conducting power, nor any decomposition or alteration has been observed.

The connexion is made by soldering a strip of copper to the zinc, and pressing this very strongly against the carbon with a clamp.

The more firmly the copper is pressed against the carbon the better will be the connexion. The copper should always be made bright where the contact with the carbon is made, and the surface of the carbon rubbed very smooth. The other parts of the carbon plate or prism may be left as taken from the retort or saw, its roughness increasing its acting surface.

Comparing these plates with plates of platinum of equal size, I can detect no difference, and from their cheapness and durability they will make a valuable addition to our voltaïc apparatus.

With a battery of 90 plates the voltaïc light was of the most splendid description, $1\frac{1}{4}$ in. long and very voluminous. My garden and a large field were brilliantly illuminated. The trees presented a very singular appearance. The leaves looked white instead of green. Small print was easily read at a considerable distance without any reflector behind the light.

The cost of a battery of 100 pairs will be about £4, whilst one of equal power with platinum negatives would be £60 or £70.

BROMINE IN GAS LIQUOR.

M. MÈNE has proved the presence of bromine in the ammoniacal liquor resulting from the manufacture of lighting gas, in which M. Bussy had previously detected iodine. (See THE CHEMIST, vol. I., page 443.)

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II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE INCRUSTATION WHICH FORMS IN THE BOILERS OF STEAM-ENGINES.

IN A LETTER ADDRESSED TO DR. G. WILSON, F.R.S.E.

BY DR. J. DAVY.

On entering on this inquiry, which I did after my return from the West Indies in December, 1848, and after communicating a short paper to the Royal Society 'On Carbonate of Lime in Sea-water,' it appeared to me desirable to collect as many specimens as possible of incrustation from the boilers of steam-vessels, now so widely employed in home and distant navigation.

By application to companies and to friends in our sea-ports, as Dundee, Hull, Southampton, Hayle, Liverpool, Whitehaven, I have succeeded in procuring specimens of incrustation formed by deposition in voyages from port to port, in the British and Irish Channels and the North Sea, between Southampton and Gibraltar, in the Mediterranean and the Black Sea, and in the Atlantic Ocean, between Liverpool and North America, and between Southampton and the West Indies. I am promised specimens from the Red Sea and the Indian Ocean,—but these I have not yet received.

The character and composition of the incrustation, whether formed from deposition from water of narrow seas or of the ocean, I have found very similar—with few exceptions, crystalline in structure, and without any exception, composed chiefly of sulphate of lime; so much so, indeed, that unless chemically viewed, the other ingredients may be held to be of little moment, rarely amounting to 5 per cent. of the whole.

From two specimens of incrustation from the boilers of steamers crossing the Atlantic, one of which you sent me, in which you had detected a notable portion of fluorine, judging from its etching effect on glass,—I also procured it; it was in combination with silica; and I procured it also so combined from two samples obtained from steamers navigating our own seas, one between Dundee and London, the other between Whitehaven and Liverpool. Of this I had proof, by covering with a portion of glass or platinum foil a leaden vessel charged with about 200 grains of the incrustation mixed with sulphuric acid, and by keeping the glass cool by evaporation of water from its surface, and by supplying moisture for the condensation of the silicated gas by a wet band round the mouth of the vessel.

After about twenty-four hours under this process, a slight but distinct deposition was found to have taken place, corresponding to the margin of the vessel,—a deposition such as that produced by silicated fluoric acid gas under the same circumstances. Thus it was not dissipated by heat nor dissolved by water, and yet admitted of removal by abrasion, either entirely or in great part;—the former in the instance of the platinum foil, the latter in that of the glass.

In addition to the above ingredients, in many instances, oxide of iron—the black magnetic oxide—was found to form a part of this incrusting deposit, collecting in one or more thin layers, and in some, especially of steamers navigating the narrower and least clear part of the British Channel, the depositions presented a brownish discoloration produced by the admixture of a small quantity of muddy sediment. Incrustations so discolored are said to be most difficult to detach.

I have stated that the incrustations, with few exceptions, were similar in their structure, and that that was crystalline: it was not unlike the fibrous variety of gypsum.

The specimens received, as might have been expected, varied very much in thickness, viz., from one line and less to half an inch.

I have endeavored, by a set of queries which I had distributed, to obtain information respecting the exact time in which the incrustations were formed, and under what circumstances; but with partial success only, owing, it may be inferred, to a want of exact observation. In one instance, that of the North American mail-ship Europa, which arrived at Liverpool on the 15th of November, at 4 P.M., having left Boston on the 7th of the same month at 9 A.M., an incrustation was found in her boiler of about one-fiftieth of an inch in thickness; and it is stated that an incrustation of about the same thickness was found on her outward voyage. This example may aid in

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giving some idea of the degree of rapidity with which the incrustation is produced, at least in the Atlantic, with the precaution of "blowing off" every three hours, and with the "brine pumps" kept in constant work. In other seas, especially contiguous to shores, and more especially of shores formed by volcanic eruptions, it is probable, *cæteris parabus*, the rate of the deposition of the incrusting sulphate of lime will be more rapid.

The results of the trials of several portions of sea-water taken up on the voyage from the West Indies to England noticed in the paper of mine already referred to, are in favour of this conclusion.

To endeavor to prevent the deposition of the incrusting matter or to mitigate the evil, various methods, it would appear, have been resorted to,—some of a chemical nature, as the addition of muriate of ammonia and sulphate of ammonia to the water in the boiler,—without success, as might be expected;—others, of a mechanical kind, with partial success,—as the introduction of a certain quantity of saw-dust into the boiler, or the application of tallow, or of a mixture of tallow and plumbago to its inside, to prevent close adhesion, and the more easy separation of the incrusting matter either by percussion, using a chisel-like hammer,—or by contraction and unequal expansion, by means of flame kindled with oakum, after emptying the boiler and drying it. Of all the methods hitherto used, that of "blowing off,"—that is, the discharging by an inferior stop-cock a certain quantity of the concentrated water of the boiler by the pressure of steam, after the admission above of an equivalent quantity of sea water of ordinary density, appears to be, from the reports made, the most easy in practice, the least unsuccessful, and the most to be relied on. But, as in the instance given of the North American steamer, it can be viewed only as a palliation.

Considering the composition of the incrusting matter and the properties of its principal ingredient—the sulphate of lime, a compound soluble in water and in sea-water, and deposited only when the water containing it is concentrated to a certain degree, there appears to be no difficulty theoretically in naming a preventive. The certain preventive would be the substitution of distilled or rain water in the boiler for sea water. Of this we have proof in the efficacy of Hall's condenser, which returns the water used as steam, condensed, after having been so used:—but, unfortunately for its practical success, the apparatus is described as being too complicated and expensive for common adoption.

Further proof is afforded in the fact, that the boilers of steamers navigating lakes and rivers in the waters of which there is little or no sulphate of lime, month after month in continued use, remain free from incrustation. This I am assured is the case with the steamers that have been plying several summers successively on the lake of Windermere. And it may be inferred, that in sea-going steamers in which sea water is used in the boiler,—or, indeed, any water containing sulphate of lime, the prevention of deposition may be effected with no less certainty by keeping the water at that degree of dilution at which the sulphate of lime is not separated from the water in which it is dissolved.

From the few trials I have made, I may remark, that sulphate of lime appears to be hardly less soluble, if at all less, in water saturated with common salt than in perfectly fresh water. This seems to be a fortunate circumstance in relation to the inquiry as to the means of prevention, and likely to simplify the problem.

If these principles be sound, their application under different circumstances, with knowledge and judgment on the part of the directing engineer, will probably not be difficult. His great object will be, in sea-going steamers, to economize the escape of water in the form of steam, and thereby also economize heat and fuel;—also, when fresh water is available to use it as much as possible; and further, to avoid using sea water as much as possible near coasts and in parts of seas where sulphate of lime is most abundant.

From the incrustation on the boilers of sea-going steamers, the attention can hardly fail to be directed to that which often forms, to their no small detriment, in the boilers of locomotive-railway engines, and of engines employed in mines and in the multifarious works to which steam power is now applied. These incrustations will of necessity be very variable, both in quantity and quality, according to the nature of ingredients held in solution in the water used for generating the steam. Hitherto I have examined two specimens only of incrustations taken from the boilers of locomotive engines, and a single one only from the boiler of a steam-engine employed on a mine—a mine in the west of Cornwall. The latter was fibrous, about half an inch thick, and consisted chiefly of sulphate of lime, with a little silica and peroxide of iron, and a trace of fluorine. The former were from one-tenth of an inch in thickness to one

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inch. They were laminated, of a grey color, and had much the appearance of volcanic tufa; they consisted principally of carbonate and sulphate of lime with a little magnesia, protoxide of iron, silica, and carbonaceous matter—the last two, the silica and carbonaceous matter, probably chiefly derived from the smoke of the engine and the dust in the air. From the engineer's report it would appear that the thinnest—the incrustation of about one-tenth of an inch—had formed in about a week, during which time the locomotive had run about 436 miles, and consumed about 10,900 gallons of water.

ON THE SUGAR PRODUCE OF THE SOUTH OF SPAIN, CHIEFLY IN CONNEXION WITH THE EMPLOYMENT OF THE ACETATE OF LEAD AND SULPHUROUS ACID AS PURIFYING AGENTS.

BY DR. SCOFFERN.

On the southern coast of Spain, in a region limited by Almeria on the east and Malaga on the west, bounded on the north by mountain ranges and on the south by the Mediterranean, is a tract of land which, so far as its climate and productions are concerned, may be aptly denominated tropical. In it, the date, palm, indigo, cotton, and sugar-cane flourish with vigor, yielding products equal in both quantity and quality to those of the tropics themselves.

The sugar-cane, first introduced by the Arab conquerors, is not only consumed in large quantities as a dessert, but also gives rise to a considerable manufacture of raw and refined sugar, a circumstance which beyond Spain itself seems to be very little known.

There is, perhaps, no example on record of any operation involving a commercial result attended with such an enormous destruction of material as the operation of extracting sugar from the cane. One portion of this loss is due to mechanical, another to chemical causes. The sugar-cane has been stated by most writers who have found opportunities of practically examining the subject to contain no more than 10 per cent. of solid non-saccharine matter, leaving 90 per cent. of juice to be extracted. Of this 90 per cent. most writers concur in testifying that in practice scarcely 50 per cent. are actually obtained; at least this is the case in the British West Indian possessions. Cane juice itself has usually been stated to contain from 17 to 23 per cent. of crystalline sugar, of which scarcely 7 per cent. in practice is actually extracted.

Considerable doubts having been expressed as to the statements of the amount of juice in the cane, and sugar in the juice, I have lately gone through a series of experiments having for their object the settlement of the doubt, and with the result of amply confirming the testimony of other experimenters. Having operated on canes from various parts of this district, by slicing them—exhausting first by hot water and then by hot alcohol, and finally drying, I obtained as a mean result about 10 per cent. of woody or insoluble matter—whilst the sugar extracted and crystallised ranged from 17 to 23 per cent., as had previously been stated. It would consequently appear that 40 per cent. of juice is actually lost in the practice of our West India workings; and now arises, as a most important consideration, the question as to what extent this loss is inevitable, and to what extent it might have been obviated by altered machinery or improved manipulation. Instead of 50 per cent. of juice extracted, 70 per cent. is much nearer the average amount yielded by the sugar-mills of this coast, although occasionally the result is as high as 75 per cent., and this, in some cases, with mills of very inferior construction. The cane, however, is passed between the rollers of the mill four times, until the refuse or megass, as the pressed cane is called, has been reduced to a state of disaggregation resembling ground tan, whereas the West Indian cane refuse is represented to be in the form of long strings, a sufficient proof that the pressure applied has been very inadequate. After the cane has finally left the mill it is immediately, in the Spanish sugar regions, subjected to the operation of pressing, sometimes by the agency of a screw, but in many cases by hydrostatic force. By the latter method, I have seen 13 per cent. of juice extracted from megass which had already yielded up 73 per cent. of juice to the mill, thus elevating the total quantity extracted to 86 per cent. out of the original 90, and consequently as a manufacturing operation leaving very little more to be desired. The hydrostatic press I consider to be an apparatus which is indispensable to the economy of every sugar estate: not only does it largely contribute to the amount of juice extracted, but what is most remarkable is, the juice resulting from hydrostatic pressure of megass is invariably, so far as my observations have gone, richer in sugar than juice yielded by the mill—a fact which seems to be explicable only on the supposition that the hydrostatic press, by virtue of its great power, is enabled to extrude those particles of sugar which microscopic exa-

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mination demonstrates to exist in the cane in the solid and crystalline form.

The subsequent stages of the sugar manufacture as carried on in Spain do not materially differ from those in operation in Cuba, and many other tropical countries. The juice is defecated or purified by lime, skimmed, evaporated to the requisite degree, and poured into earthenware moulds, the contents of which are finally exposed to the operation of claying. In one manufactory, however, at Almunecar, lime is no longer used on account of its well-known injurious effects on sugar:—no other agent having been substituted in its stead, but sole reliance being placed on the coagulation by heat of albuminous matters present in the juice, and their final removal by skimming. Under this system of manufacture the sugar produced is light colored, but badly grained, and the unseparated albuminous matters are present in such quantity that every 100 parts of the concentrated saccharine juice as it comes from the teache, or last evaporating pan, yield only 40 parts of crystallised sugar on cooling, the other 60 per cent. remaining in the condition of molasses perfectly uncrystallisable until some adequate means for defecation can be resorted to. The chief object of my residence in this sugar district was to superintend the erection of machinery for manufacturing sugar by my own process. The site of our operations is Montril, about forty-five miles south of Granada,—in a manufactory furnished with apparatus of the rudest character. Up to this period (July 9) our own vacuum apparatus has not been sufficiently advanced to enable us to pursue our operations by its aid; nevertheless, owing to the superior defecating power of the subacetate of lead, we have, even with the old and rude machinery, obtained a result of more than 16 instead of 7 per cent. of sugar. Our striking teaches, or final evaporating pans, we were under the necessity of removing in order to afford the requisite space for our own machinery; hence we were reduced to the necessity of concluding our process of concentration in a brass pan of conical form and holding about 600 imperial gallons, thus materially increasing the difficulty of the evaporative process. Hitherto only one-sixth per cent. on the juice of subacetate has been used,—but I imagine the quantity may be advantageously increased. As filtration is indispensable for the conducting of this process, considerable fear was entertained lest fermentation might supervene. This fear, however, practice has demonstrated to be groundless, inasmuch as we possess in sulphurous acid an agent highly antagonistic to fermentation. Another speculative fear was that danger might arise from the lead employed: this fear, too, practice demonstrates to be entirely without foundation, for not only is the sulphite of lead most easily removed,—but even were it to remain no injury could supervene, inasmuch as this agent is as harmless as chalk.

Dr. GREGORY stated that he had made experiments on the sulphite of lead formed in this process. He admitted that an infinitely small proportion might still remain in the sugar, but that he considered it quite innocuous. He had indeed fed rabbits and dogs with food which had been united with this sulphite of lead, and the result was that they thrived amazingly, showing no symptom of any of the known effects of lead. Dr. Gregory also remarked that in testing sugar for lead with the hydro-sulphuret of ammonia, iron was often mistaken for the former metal.

Dr. CHRISTISON contended that we had no evidence that the sulphite of lead was innocuous. It was true that in cases of poisoning by carbonate of lead sulphuric acid was administered to convert it into the comparatively insoluble sulphate; but this was a case widely different from the slow accumulation of lead in the system. He adduced some examples of exceedingly small doses of lead being taken in water for more than twelve months before its evil effects became apparent. He, therefore, thought it yet remained to be proved that the sulphite of lead was without action on the system, since we know nothing of the influence of the solvents it would meet with in the system, or of the influences of vital action. Rabbits, he was prepared to say, should be entirely rejected in these inquiries, since he had found that they were unaffected by many poisons. Dogs and cats were the only animals which could, from their internal structure, be regarded as representatives of the human system in such investigations.

ON AN ACCELERATING PROCESS IN PHOTOGRAPHY.*

BY J. MIDDLETON, ESQ., F.G.S.

THE following method of preparing sensitive paper may, perhaps, be welcome to photographers on account of the great sensibility which it confers; it has, moreover, the additional recommendation of being very simple and constant in its results.

I beat up albumen of the egg of the duck until it becomes liquid, and then mix it with

* *Philosophical Magazine.*

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water in the proportion of 80 grains of the former to an ounce of the latter. I add to this solution iodide of potassium in the proportion of 25 grains to the ounce. Prior to the application of this solution, wash the size from the side to be rendered sensible, by means of a camel's-hair brush, and when dry, I float the paper on the solution, for from three to four minutes, and when drained and dried I lay it aside for use.

When about to be used for taking a picture, the paper, prepared as above described, is to be washed with aceto-nitrate of silver, in the proportion of 60 grains of nitrate and 80 grains of acetic acid to an ounce of water (Talbot's strength). I apply the solution with a glass rod, using about 40 grains of it to a quarto page, and allow the paper to dry in the dark. It is now ready for the camera. While applying the sensitive coat, as also while bringing out the picture, I take the precaution of using a yellow light. I find that from ten to fifteen seconds is, with ordinary sunlight, sufficient exposure, the latter being generally too long.

When the picture has been taken, no trace of it appears on the paper, but it soon comes out on the application of a saturated solution of gallic acid. I turn up the edges of my paper and pour on the solution until the paper is entirely covered, and keep it so until the picture has come out sufficiently, when I fix it in the usual way.

I find that if bromide of potassium be substituted for the iodide, in the first process, a picture is obtained; but the time then required for exposure is about one minute. Again, bromide or chloride of potassium does not serve to accelerate as in the ordinary processes, but the contrary; gallic acid, too, added to the acetonitrate, destroys sensitiveness. I find, also, that if the albumen be dried, and afterwards dissolved again and used as above described, it has lost its photographic value—a circumstance which would seem to indicate that photographic properties are connected with or dependent on molecular arrangement.

The employment of albumen in photography is not new; it has not, however, so far as I am aware been used in the precise way or with the effect stated above.

Agra, 18 June, 1850.

ON THE ECONOMY OF MANURES.*

A LECTURE DELIVERED BY DR. ANDERSON, CHEMIST TO THE HIGHLAND SOCIETY.

It has appeared to me that the present affords an advantageous opportunity of calling your attention to questions which must unquestionably depend for solution on the mutual exertions of science and practice. For I hold it to be certain that the two must go together, and that though some of the facts we require may be determined in the laboratory, there are many questions which, though suggested by science, can be established only as facts by experiments in the field, performed with every attention to care and accuracy. I hold also that neither of these methods of experiment will in themselves suffice; they must go hand in hand if our results are to be of value. Separately the chances are that they lead to mere speculations, of which science will supply one set and practice the other; for you must allow me to say that practice has abundance of speculations of its own, which are often much wilder than those on which science ventures. In discussing the general questions of the economy of manures on the present occasion, I must be contented to do so in a general manner, as your time will not permit me to go into any details, and I shall advert, in the first place, shortly to the general properties of manures. If we examine then any of our common plants, we find it to be composed of a considerable number of chemical substances. These substances may be divided into two great classes, separable from one another by a very simple experiment, which is neither more nor less than burning the plant. When this is done we obtain its ash, containing the whole of one of these classes; the other has, in the process of burning, passed into the state of gases, and so escaped the observation of our unassisted senses. The former of these are called the mineral or inorganic constituents of the plant, the latter the organic constituents, because they are peculiarly present in all organised beings. The latter of these classes is a limited one, and contains only four substances—carbon, hydrogen, oxygen, and nitrogen. The former is much more extensive, and comprehends a considerable number, of which the most important are sulphuric acid, phosphoric acid, lime, magnesia, potassa, and soda. Now the existence of the plant depends upon its obtaining all these, as well as one or two less important substances, in sufficient quantity; without these it cannot flourish, and just in proportion to the the amount in which they are supplied will be the luxuriance of its growth. I say the growth of the plant will be proportional to the supply of these constituents. This statement, however, is

* From the *Agricultural Gazette.*

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not to be taken in its widest sense, because Nature has fixed a certain limit beyond which no supply of these substances, however liberal, will raise its growth, but up to that limit the statement is substantially correct. From whence, then, is the plant to derive these substances? And in answering this question it is necessary to distinguish between the two classes of substances to which I have already referred, and to inquire separately into the sources of each.

Of the organic constituents there can be but one source, the soil namely, which to be fertile, must contain the whole of these substances in greater or less quantity. It is different, however, with the organic constituents, which have a two-fold source, and of which part, or even the whole, may be derived from the surrounding atmosphere. The atmosphere is, in fact, a great reservoir of the organic constituents of plants, of which it contains all four; two of these, nitrogen and oxygen, forming almost the whole of it; the other two, carbon and hydrogen, existing in smaller proportion in the forms, respectively, of carbonic acid and the vapor of water. It must be understood, however, that all soils contain a certain quantity of the same substances, in the form of what is called organic matter, in a state of which all these four substances may be supplied to the plant. Now, every fertile soil contains all the constituents of the plants which grow upon it, and that, too, in sufficient quantity to supply many successive crops, a position which I have had recently an opportunity of illustrating in a very complete manner, in a series of analyses of the Wheat soils of Scotland, published in the last No. of the Highland Society's Transactions. I have there shown that even nitrogen, of all others the element which we should least expect to find in them in abundance, nevertheless exists in what must be considered a comparatively large proportion. But it is important to observe that it is not enough that these substances shall exist in the soil; it is further necessary that they be present in a state in which they can become available to the growth of the plant. Now, to provide for this, Nature has introduced an extremely beautiful and important provision. In order that these substances shall be absorbed by the plant, they must exist in a soluble condition. It is, however, very manifest, that if the whole valuable constituents were soluble, the good effects of such an arrangement would be altogether defeated, for the rains would soon wash away from our soils all that they contained of valuable matter. To obviate this, however, Nature has so arranged it that these constituents exist in the soil in the state of insoluble compounds, which under the influence of air and moisture, gradually undergo a series of very complex decompositions, which slowly liberate the constituents, as they are required to support the life of the plant. But Nature has fixed a limit to this change, and has caused these constituents to become soluble with extreme slowness only, and in no greater quantity than is requisite for supporting that amount of vegetation which the general economy of the globe requires.

Now, the whole principle of cultivation is to obtain, by proper treatment, from a given surface of land a greater amount of vegetation than it is capable of producing in a state of nature.

And this is effected partly by tillage, which breaks up the land, and by the admission of air and moisture facilitates the decompositions, by which these valuable constituents of the soil are liberated from their insoluble state. The other and far more important means is by the addition to the soil of those substances which the plant requires, in other words by the use of manures. A manure, then, ought to contain all the substances which a plant requires for its growth. And this is unquestionably what a manure of theoretical composition should do. Nay, more, it ought to contain these substances exactly in the proportion which the plant requires, so that no waste may occur. It must, however, be manifest to every one acquainted with agricultnre, and still more manifest to every one acquainted with chemistry, that it is impossible to carry out practically what is true in theory; nevertheless, the aim of skilful and scientific practice ought to be to approach as near to theoretical perfection as it is possible to do, though in the very nature of things we cannot even hope absolutely to arrive at it, or even near it. Although, however, we cannot hope to arrive at perfection, we may advantageously aim at a somewhat lower and less difficult standard, for experience and science concur in showing that all the constituents of a manure are not as equally important, but that those are most essential which the plant has greatest difficulty in obtaining from other sources. Now, in this point of view, nitrogen is the most important of all the constituents of a manure, because it is that which Nature supplies least abundantly. You may possibly express some surprise at this statement, considering that I, not many minutes since, mentioned that

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it is at present in enormous quantity in the atmosphere. But it so happens that nitrogen is exactly of all others the substance which most peculiarly requires to be presented to the plant in a special condition. It has been established on most unequivocal evidence that the plant cannot absorb nitrogen as such, and that all this immense mass of nitrogen existing in the air is not strictly useful to the plant, while it is only a very minute quantity existing in it, in the state of ammonia, which is of immediate value. And of the immense disproportion between the amounts of nitrogen in what I may call an inert and an active condition, some idea may be formed when I mention that 100 lbs. of atmospheric air contain about 77 lbs. of nitrogen, and, according to a recent determination, not more than $\frac{1}{4}$ of a grain of ammonia.

Next to ammonia in importance may be placed phosphoric acid, which is likewise a comparatively rare natural product, and of which also the great source in animal and vegetable sources, all of which, but especially animal substances, contain it in quantity. It is true that it is found also in the mineral kingdom; but it exists there so sparingly that as yet scarcely any advantageous use has been made of that which is obtained from this source. You will observe, then, and it is a matter of great practical importance, that the principal source of the two most important constituents of plants is from plants themselves; for even that portion obtained from animals comes originally from the plants upon which these animals have fed. And the same may be said of potassa, of which the great source is still from plants. This is a point which I wish to impress particularly upon you, that plants form the great source of these substances; and that this is true, not merely of these substances as manures, but even when you go into a druggist's shop, and buy pure ammonia, phosphoric acid, or potassa, every atom which you get has at some time or other existed in a plant or an animal. These observations lead me directly to the consideration of that manure which consists of the decomposing portions of plants, and that of course is farm-yard manure, the most important of all, that on which the farmer must always be mainly dependent, and I think I may also say, that regarding the economical management of which we have the least amount of definite information. I beg it to be understood as my decided opinion, that farm-yard manure must always be the farmer's main stay.

Some people still seem to expect that some complete substitute will be found for farm-yard manure. I can assure you, however, that any such supposition is utterly extravagant, and is certainly uncountenanced by chemistry. I do not mean to say that chemistry could not produce a substitute; but what I mean is, that the farm-yard manure must always be much cheaper than any substitute which could be manufactured; and the reason is to be found in the fact, that the constituents of such a manure must be extracted from plants, which must necessarily be expensive. While even supposing that to be done, farm-yard manure must, in the very nature of things, still always be produced. No question can then be conceived of more importance than that of obtaining this manure in its most perfect state; but how that is to be done is exactly one of those questions still unsettled, and which I believe to require very complete and careful field experiments. The exact chemical estimation of the comparative values of different specimens of this manure is a very difficult matter; partly from its extremely complex nature, and partly from the many questions it involves. Of course, good farm-yard manure will contain more or less of all the constituents of our crops; but, in estimating its value, we must be contented to take into consideration only its most important constituents, and, in this way, I conceive we may obtain a sufficiently near estimate, by knowing the amount of nitrogen and phosphoric acid which it contains; but of these, for many reasons, the first is by far the most important, as it is in respect to it that the value of farm-yard manure appears to vary most. In the management, then of farm-yard manure, two different questions require to be considered—first, the production of a manure containing the greatest possible amount of nitrogen; and, secondly, the successful conversion of that nitrogen into ammonia. It is not unimportant, of course, that the other constituents of the manure should be present in abundance; but it may be assumed, as generally true, that the treatment likely to produce the greatest amount of nitrogen will be that which will produce the most valuable manure in other respects.

In regard to the first of these questions, there is little information. It is a common statement, however, that the value of the manure is dependent upon the nature of the food with which the cattle which produce it are supplied; that, for instance, cattle fed upon oil-cake produce superior manure to those fed on Turnips. I am aware that this opinion is not universal, as I have heard it disputed by farmers of

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skill and experience. I am inclined, however, to believe that the opinion is to a certain extent correct. Supposing, then, that two samples of such manure differ, it must be obvious that it is the dung and urine of the cattle which differ; the litter mixed with such dung will be the same in both cases. Now, some experiments made in the laboratory, on the pure dung and urine of cattle fed on Turnips and oilcake, appeared to me to confirm the opinion of the greater abundance of nitrogen in the produce of animals fed with the latter food.

It will not do, however, to draw conclusions in such cases from a single analysis, so that I was anxious to have repeated and extended the experiments, but circumstances not within my own control have hitherto prevented my doing so. I would beg you, however, to observe that supposing it to be made out distinctly that farm-yard manure produced by oil-cake contains more nitrogen than that from Turnips, still this would not embrace the whole question. It would if you were to buy the manure, when, of course, all that you want is to get as much nitrogen as possible in the 100 tons, or any other quantity which you may wish to buy. But it is quite another thing when you come to produce the manure on your own farm. The question then is, not whether 100 tons of the one contain more nitrogen than 100 tons of the other; but whether the whole quantity of nitrogen produced by the one method of feeding is greater than the whole quantity of it produced by the other. Now, we have no experimental information on this point; but I think it may be doubted whether in this point of view there is any such difference, because you will observe that though oil-cake contains more nitrogen—in fact about 2½ times as much as Turnips—still there is a much greater disproportion in the quantities of these substances with which you supply the cattle. You give an ox daily 1 cwt. of Turnips, but no one gives 30 lbs. of oil-cake daily, but more nearly 3 lbs.; so that, in fact, the ox fed on oil-cake actually on the whole receives less nitrogen than when fed on Turnips. To pass then to another question—supposing cattle to be fed in exactly the same way, so as in fact to produce manure which at the moment of formation is of uniform quality, what are the circumstances under which that manure can be preserved with the least loss of its valuable matter? As regards the general question of the preservation of manure, I apprehend that the most important matter is its protection from air and moisture. In the way a common dung-heap is made, we have, in fact, exactly the conditions to occasion loss of its valuable constituents. It is exposed to a more or less free current of air, which facilitates the volatilisation of the ammonia as it is formed and it is exposed to the falling rain, which washes out the soluble salts, and what ammonia the winds have spared, into the subjacent soil. It is true that the former of these sources of loss can be got the better of by the use of acids or of gypsum and mixing with earth; but when the ammonia is thus fixed, as it is said, it is fixed only as regards volatility, for it is still soluble, and liable to be washed away by rain. In order to have farm-yard dung in the best state, it must be preserved under cover, and my impression is that the introduction of covered dung-pits is likely to prove of great importance. There seems to me no doubt that in this way manure, in whatever way produced, must be best preserved. There appears, indeed, to be but one objection, which is, the expense of erecting a roof of sufficient extent to cover the whole manure of a farm. But surely, in these days of cheap building, some sort of inexpensive cover may be contrived. In order to ascertain this, we should have to ascertain, by actual experiment, what is the amount of gain by having the manure kept under cover, so as to know whether it is sufficient to leave a profit on the expense of covering it. We have another matter to attend to also, in the management of farm-yard manure—its fermentation namely, by which is meant the production of such a decomposition as converts the nitrogen present into ammonia. The importance of this decomposition depends upon the fact that by this means we obtain a manure which acts with greater rapidity than one in which this decomposition has not been effected. The fact is, that the formation of ammonia takes place much more slowly when it has been incorporated with the soil than when it is heaped up in the dung-heap; and, as the nitrogen must pass into the state of ammonia before it is absorbed by the plant, we require to effect as much of that change as possible, if we are to have a manure of rapid action.

I have referred hitherto solely to natural manures, and have laid before you my view that no artificial manure will ever prove a substitute for that of the farm-yard; but though that is the case, they may be, and I believe are, most important auxiliaries. Take the commonest kind of artificial manure—I mean, of course, guano—the finest quality of which is the cheapest and the best of the class. I say the cheapest and

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the best; and it must necessarily be so, because the constituents which are of greatest value to the agriculturist, are given in it in a larger quantity than in any other compound for the same money. My advice then is to buy the best guano—never purchase inferior. The inferior is greatly more expensive. The decrease in the money value for which it might be obtained is nothing to the decrease in its valuable constituents as compared with the better sorts. The Peruvian is the best kind of guano, and it is by far the cheapest. Farmers are exposed to much risk of imposition in this matter; adulteration is carried on to an extent which it is difficult to credit. I have recently gone over the number of samples of guano that had been forwarded to the office of the society for analysis, to the number of 30 cases, and have found that of that 30 there have been only 9 samples of such a quality as I, if purchasing, would have been disposed to accept. And this gives no accurate idea of the proportion of good to bad guano which is in use. Numerous samples of good guano have come to the office, but few of those that are thoroughly adulterated, because the venders of such take care to keep as far as possible out of the reach of the chemist. Take guano of the best quality and you will find that two things enter largely into its composition, viz., ammonia and phosphoric acid, the two substances, as I have previously stated, the presence of which is most valuable in farm-yard manure. Now, in peruvian guano you will find about 17 per cent. of ammonia and of phosphate of lime, a compound of lime and phosphoric acid, 23, 24, or 25 per cent., according to circumstances. In inferior guanos there may be found 23 or 24 per cent. of phosphate of lime, and 1 or 2 of ammonia; and this, instead of being sold at one-third of the price of the other, as it should be, is sold generally at two-thirds. Guano may be considered as the type of a class of manures, and bones may be taken as belonging to it also. The value of that kind of manure is dependent on two conditions. Some use burned bones. Now, in certain circumstances, this may be advantageous. The addition of phosphate of lime alone may be needed in certain soils. Such a case occurs in the pasture land of Cheshire. The application of bones to that exhausted soil operates almost as a charm upon it. The peculiar nature of the tillage under which it has been kept—all the butter and cheese raised upon it being conveyed elsewhere—reduces it to that state that the addition of phosphate of lime acts powerfully, and is indeed eminently beneficial. But, in general, such is not the case, and therefore they should give the preference to bones that were unburned. There is another instance of a similar kind to which I may refer. In many cases, I believe, bones are sold from which the glue has been extracted by boiling. This glue is a valuable commercial product. It is used in weaving, for stiffening yarn and other manufacturing purposes; and several manufactures have large boilers in which the glue is extracted. The bones are sold afterwards at no diminution of price from that of unboiled bones.

ON THE SOLIDIFICATION OF MORTAR AND ITS PROPERTY OF RESISTING THE ACTION OF WATER.*

BY M. H. DE VILLENEUVE.

M. VICAT, in his researches into the action of cements, has pointed out the principal properties of different kinds of mortar, including that known as hydraulic mortar. The power of resisting the influence of water is communicated to lime by a certain combination of silica and alumina; this combination may be formed in two different ways, that is to say, either directly, by calcining calcareous clays, or indirectly and gradually, by the action of burnt marl or clay on lime.

The calcination of carbonate of lime, containing from 1 to 6 per cent. of clay, produces ordinary lime; if the quantity of clay be greater (equal to from 6 to 23 per cent.) the lime is suitable to be made into hydraulic mortar. With from 23 to 27 per cent. of clay, the result of the calcination of the calcareous compound is termed cement. Marls and clays, subjected to a proper degree of heat, produce what is called pozzolana, which is more or less energetic, according to the purity of the clay from which it is obtained. Practical experience has shewn that, between the lime suitable for hydraulic purposes and cements, a line of demarcation exists, in the form of the lime, containing about 23 to 28 per cent. of clay. This combination neither slakes into a grey powder when wetted with water, nor does it cohere permanently when mixed with water and beaten together. When calcined calcareous compounds are moistened with water they experience an augmentation of volume, owing to the solidification of a portion of water in combination with them, and the lime breaks down into a powder. The com-

* *Comptes Rendus* and *Newton's London Journal of Arts and Sciences.*

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bination with water takes place with a violence, rapidity, and heat, proportionate to the smallness of the quantity of clay; the proportion of water absorbed also depends on that circumstance. When water is made to act on ordinary calcareous substances after calcination, the absorption of the water, and the breaking down of the lime, will not take place when it is of the kind containing 23 to 27 per cent. of clay: but the mass will only be divided into lumps. It has been found that, when lime containing only from 23 to 28 per cent. of clay, and cements, are submitted to the action of water at a high temperature, even if steam only be employed to moisten the lime, it will swell up and then fall to powder in the same manner as hydraulic lime, and the properties of the calcareous matter, slaked in the manner above mentioned, are equal to those of hydraulic lime of the best kind. If, on the other hand, instead of favoring the action of the water, it be impeded, either by keeping down the temperature, or by adding it only in small successive portions, the swelling up of the mixture, and the formation of that noxious combination of clay and lime, in which the former is in the proportion of 23 to 28 per cent. of the latter, can be checked at pleasure. This peculiar kind of lime, if submitted to the slow action of water, or even to the hygrometric action of the atmosphere, and afterwards pounded up, will produce an excellent cement. By submitting the argilliferous lime to the action of water, under certain conditions, it is capable of being used instead of hydraulic lime of the best quality; and, by treating the same kind of lime with small quantities of water at a low temperature, and afterwards grinding the mass as above described, a valuable material for cement is obtained. Certain carbonates of lime, sometimes termed subcarbonates, give rise to a product similar to the argilliferous lime; and, if slightly moistened and ground, it produces durable cement, which can be employed alone, or mixed with ordinary hydraulic lime. If the action of the water on the subcarbonates be assisted by heat, it falls into powder in the same manner as common lime. If the temperature be raised, the substance is acted on like a mixture of lime and the neutral carbonate of lime,—a phenomenon similar to the decomposition which is observed when hydraulic lime is acted on by a large quantity of hot water. By causing water to act slowly upon the imperfect carbonate of lime, or rather by exposing it to the hygrometric influence of the air, and afterwards grinding the mass, a substance is obtained capable of persistent cohesion. These considerations laed to the belief that the hydraulic property of some kinds of lime is attributable, not only to the presence of silica and alumina, but to that of carbonic acid, or, indeed, any other electronegative substance, capable of forming an insoluble compound with lime. Insolubility must, then, be regarded as the essential peculiarity of hydraulic lime. Carbonic acid renders lime hydraulic, not only by directly combining with it, but also by the indirect action, as in pozzolana; thus cement and hydraulic lime which, by long exposure to the air, have become charged with carbonic acid, may be mixed with ordinary quick lime, and may then be used instead of the best pozzolana. By pounding hydraulic mortar after it has stood for four years, a true pozzolana was produced, which became quite fixed under water, in the space of fourteen hours. As a hydraulic principle, carbonic acid is the most economical; but it does not produce the most cohesive mortars and cements.

A calcination or moderate roasting, produces a modification in calcareous clays, by which they are brought to a state very similar to that of lime containing 23 to 28 per cent. of clay. The hydratation of these substances, increased by heat, or impeded by a low temperature and a limited supply of water, gives rise to two classes of products, namely hydraulic lime and cement. These latter products are, moreover, endowed with a remarkable degree of cohesion; indeed, cement has been produced by this process capable of scratching the surface of marble. The most remarkable results of this kind are, however, obtained from calcareous clays, rich in alumina; these are the compounds which experience the highest degree of contraction in the process of calcination. From what has been said, it appears that the various products of the calcination of calcareous compounds have each a certain utility, and that all of them may be profitably employed either before or after being burnt. Practically, it is evident that hydraulic lime may be obtained economically in all localities where beds of chalk or limestone are found, and that the various products of the unequal calcination effected in ordinary kilns may be turned to advantage.

The system above detailed has been tried for fifteen years in some parts of France. 350,000 cubic yards of masonry, in the railway from Marseilles to Avignon, prove at the present moment the advantages of the system; in the neighbourhood of Marseilles, there are upwards of a million cubic

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yards of masonry, constructed with hydraulic mortar, (made as above described) at a price not exceeding that of work executed with mortar made from ordinary lime.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in the Manufacture of Fuel and Manure, and deodorizing and disinfecting Materials. HENRY JAMES TARLING, Bayswater, Middlesex, commission agent. Patent dated March 7, 1850.

THE improvements in "the manufacture of fuel" consist in employing refuse tan, which is to be well mixed with gas tar as it comes from the works, in the proportion of one bushel to a quart of tar. The fuel is then ready for use, or it may be moulded into bricks, if preferred. Instead of tan, peat may be used in the same proportion, and resin, or resin oil, may be substituted for the tar, in which case one pint to the bushel of tan or peat will be sufficient.

In the manufacture of "manure," the patentee employs highly-carbonized refuse tan and night-soil in equal parts. The prepared tan acts as a disinfector, both in the case of its use with night-soil and in other applications thereof.

The patentee does not claim the exclusive use of tan or peat for fuel, as he is aware that they have been previously employed in combination with other materials, but he considers the application of tan and peat, combined with tar or resin, or resin oil, as above described, to be new; without, however, confining himself to the exact proportions above given.

Claims.—1. The application of highly-carbonized refuse tan and night-soil for the purpose of manure.

2. The employment of the tan charcoal for the purpose of disinfecting and deodorizing night-soil and other materials.

Certain Improvements in the treatment of Copper and other Ores, and obtaining products therefrom. THOMAS IRVING HILL, Clapham, Surrey, gentleman. Patent dated March 9, 1850.

These improvements apply principally to the smelting of refractory copper ores, and consist in the employment of a flux composed of Galena (sulphuret of lead) and baryta, or sulphate or carbonate of baryta. In place of baryta, carbonate or sulphate of strontia may be substituted. The proportions are one-tenth galena and nine-tenths baryta, &c. The flux is to be added to the metal in the roasting furnace in the proportion of one-eighth flux to seven-eighths of ore yielding 12 per cent. of copper.

Another improvement is the employment of oxygen gas, to increase the heat and cause more perfect combustion of the coal. Retorts are fixed near the furnaces, in which the gas is generated by exposing therein black oxide of manganese to intense heat. The gas evolved passes to a receiver, and thence by pipes to the fire, either through holes cut in the side or over the bridge of the furnace.

The patentee also employs carbonate of baryta as a flux for iron ore, and introduces oxygen gas to assist combustion, as above described.

Claims.—1. The employment of galena, or sulphuret of lead, in combination with baryta, or carbonate or sulphate of baryta, or carbonate or sulphate of strontia, as a flux for copper ores, as described. Also the generation and application of oxygen gas for increasing heat in smelting and roasting furnaces, as described.

2. The employment of carbonate of baryta as a flux for iron ore. Also the application of oxygen gas, as described.

Improvements in treating Peat and other carbonaceous and liquid matters so as to obtain products therefrom. WILLIAM BENSON STONES, Golden Square, Middlesex, Manchester warehouseman. (A communication.) Patent dated March 7, 1850.

Claims.—1. A machine for compressing peat.

2. A process of carbonizing.

3. The application of carbonic acid gas to the extinction of glowing char-peat.

4. The employment of peat-gas produced during the operation of carbonizing, for the purpose of heating the retorts.

5. The application of a series of receivers to the distillation of the residuum, and the obtaining products therefrom.

6. A process of obtaining "peotole" and "peupion" by rectification.

7. A process of obtaining "peotine."

8. The application of sulphur and peat to the manufacture of bisulphuret of carbon, and application of the peat and sulphur residuum to the manufacture of gunpowder.

9. The manufacture of artificial fuel from anthracite and char-peat.

10. The impregnation of surface peat

* Collected from *The Mechanic's Magazine*.

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with resin-oil, &c., for the manufacture of fire-lighters and revivers.

11. The purification of peat gas, as described.

12. The obtaining of heat and light by the combustion of peat gas in atmospheric air, when a coil or plate of platinum is employed.

13. A peculiar construction of gas-burner, and application of these burners for the purpose of blow-pipes, &c.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE PHARMACEUTICAL SOCIETY.

LAST month we announced that Mr. Jacob Bell's name was to be omitted from the title page of his Journal. We made this statement upon the assumption that he would carry out the recommendation to that effect of a committee appointed by the Council to consider the subject of the Memorial. He has set the Council and their committee at defiance by not adopting their recommendation. We admire him for his courage in not blinking the matter at issue by such a ridiculous compromise; for the real question is, whether or not he shall enjoy the monopoly of supplying the whole of the members and associates of the Society with his Journal.

The Journal is solely the property of Mr. Bell; he alone is responsible for its contents. Therefore, whatever credit or blame belongs thereto, he has rightly determined to bear on his own avowed responsibility. We have strong reasons to suspect that those who advocate this compromise are desirous to get the Journal into their own hands to further their own selfish schemes. Such a change, to the members, would be only for the worse. Whatever Mr. Bell's objects may be in fighting for the monopoly, he is well known to be a more generous and disinterested man when placed in power than his compromising colleagues would be were they in his position. Their jealousy of him would have caused them to have crushed his monopoly long since, had they not feared that their darling hopes and interests must have fallen with it. Thanks to their sagacity, they have judged correctly.

But, shrewd and designing as they are, their ambition and their cupidity will beat them at last, for the Society is fast progressing towards dissolution under the unquenchable thirst of those leeches who have fastened upon its vitals.

It could be clearly shown that a subscription of five shillings a year from each of the members would be amply sufficient to maintain in efficiency all the legitimate objects and functions of the Society. Of course those monstrous absurdities, the genteel pauper school and its monopolising propagandist coadjutor, the Journal, must go to the wall under such a depleting system. The monthly meetings, the examination board, the library and the laboratory for the use of the members only, and the publication of the Society's transactions, could flourish upon such a revenue, as, though small the amount of each individual's contribution, it would be large in the aggregate, from the greater number of chemists who would join and support the Society under this desirable arrangement.

These necessary reforms will never be accomplished unless the management of the Society passes into other hands, because those on the Council who have energy are opposed to them from interest, and those who are not so fettered have neither the spirit nor the ability to originate and develope such an organic change.

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In fact, so extravagantly high is the present subscription to the Pharmaceutical Society, in comparison with the little advantage it confers in return, that if any one of numberless seceders be asked why he has withdrawn, he will almost invariably say: "Do you think I am fool enough to pay a guinea and a half yearly for Bell's Journal, when I can purchase it from any bookseller for twelve shillings if I want it."

This plain answer contains the philosophy of the whole matter. Men will not be fools enough to throw away money upon that which returns neither a present nor a future equivalent, as is unmistakeably the case with the position of the majority of the members of this Society.

The Society commenced its career with a promise which proved a palpable hit, and in consequence has traded upon promises ever since. But, happily for the interests of the pharmaceutical profession, its promises are now at a discount. They are estimated at something near their real value. Having wasted nine years in this exercise of their inventive faculties, and exhaustion having supervened, the Council would gladly give a heavy premium to anybody who could supply them with a new and specious promise. In default thereof, they would wittingly fall back upon a Medical Reform Bill, which would appear to endanger the rights of the chemists. But, unluckily, no Hawes or Warburton will come to the rescue. The Society must perish. Like all great impostors, it will find a Sir Peter Laurie who, *con amore*, will hasten it on to its final doom.

In calling the Pharmaceutical School a pauper establishment, we intend no insult to the students thereof. In all probability they pay the full value of their education when they pay only one-fourth of its cost. In fact it is much to be doubted whether any one of them would pursue his studies there at all if he paid four times the present amount levied on him for the privilege, reasonably considering it would be quadruple its value.

Bitter indeed must be the disappointment to the student, after having finished his studies and obtained his diploma, to find, when he has commenced to practice his profession as a principal, that all the vauntings of the Pharmaceutical Journal respecting the advantages and necessity of a scientific education are a mockery and a snare: a mockery, because it is a well-known fact that the best businesses are made, not by scientific men, but by crafty, plausible, audacious nostrum-mongers; a snare, because the object of the promoters of the School is not so much to educate, as to put money into the pockets of those connected therewith.

We assert that Mr. Bell, when he preaches about the immense benefit, in a pecuniary sense, that a scientific education is to the pharmaceutist, is quite illusive, as, indeed, he must know. Moreover, we could prove, did not delicacy for the feelings of others prevent us, that the most gifted members of the Society are those who receive the least patronage. In truth, these able men are a living contradiction to his doctrines. It would redound much more to the honor and generosity of Mr. Bell and his colleagues if, instead of continuously impressing upon pharmaceutists the value of a scientific education, they would devote a little of their influence and energy to cause the man so educated to be appreciated by the higher grades of the profession.

The rulers of the Society will discover, when too late to repent, or to retrace their steps, the fatal consequences of rousing the antagonism of all their talented members, instead of showing a due estimation of, and endeavoring to develope, the natural and acquired gifts of those who by their contributions to science are alone capable of conferring *èclat* on such institutions.

STENOGRAPHIC PRESCRIPTIONS AND THE PHARMACEUTICAL JOURNAL.

Most amusing it is to observe with what caution the editor of the above Journal introduces to his readers in the last number of his periodical, an article on the collusion

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existing between medical men and chemists. Such dangerous and delicate ground, to be trodden on, must only be attempted when an excuse is offered by the publication of a resolution of the Pennsylvanian Medical Society, as though Mr. Bell had never before had his attention called to this topic, which is one of the most crying evils which exist to retard Pharmaceutical progress and independence, because, when such corruption is the only sure passport to success with Pharmaceutists, they will be necessarily indifferent to the acquisition of high qualifications. With an assumed simplicity he remarks, that "it is rumored that such things are done, and it is generally believed that the rumor is not unfounded." Now we do not tax Mr. Bell with resorting to any disreputable means of acquiring business himself, but we charge him with pretending ignorance of a practice, the knowledge of the existence of which is an affair patent to every one in the profession. Fearful of damaging himself with what he terms the respectable members of the medical profession, he says, that he is convinced that they are not guilty of this degrading practice: but we can tell Mr. Bell that, if accepting bribes from chemists in any shape, were to be tests of the respectability of most of what he calls the respectable members, we fear he would have to invent another test for respectability, if he wishes to stand high in their estimation.

We should like to detail the results, were it not libellous to do so, of our experiments on some members of the profession, whom Mr. Bell does not hesitate to call respectable, when tried according to his ordeal, viz.: "when the author of a stenographic prescription refuses to disclose its composition, or equivocates and appears to be much amazed at the inquiry, there are strong grounds for the suspicion that a collusion exists."

It is quite evident that in writing this article, Mr. Bell was hampered by many considerations, as it abounds with the *suppressio veri* and the *suggestio falsi*. He was neither hearty nor candid in his denunciations, for after having laid down a general proposition that the system of stenographic prescriptions was disgraceful, he allows of so many exceptional cases by which the proposition can be evaded, that it renders him ridiculous in having attempted such a lame and impotent attack on a notorious abuse. His defence or apology of these exceptional cases, we consider unmitigated humbug. The only conclusion we deduce from this article is, that it is utterly absurd for a man who keeps a shop to edit a Journal.

E. M. L.

MANUFACTURE OF SUGAR BY DR. SCOFFERN'S PROCESS.

We lay before our readers two reports on the process of refining sugar, invented and patented by Dr. Scoffern, and which, as is well known, consists in treating the sugar in the first instance with subacetate of lead, and then precipitating the lead in the form of sulphite by means of sulphurous acid. The first report, by Professors T. Thompson, Graham and Hofmann considers the question in its chemical bearings: the second, by Doctors Pereira, Taylor and Carpenter, relates to the toxicological part of this question. We also publish a return made by Mr. George Philips, Surveying-General Examiner to the Board of Inland Revenue.

The tendency of these reports is to show that this process is by no means so free from objection as Dr. Scoffern and his supporters have stated. As we have not space this month to give the counter-statements of Dr. S. and those who advocate the use of his process, we shall abstain from making any other remark than that it appears to us that further investigation is desirable; the public confidence in sugar must not be shaken: at the same time, as Dr. Scoffern's process would, as it is stated, do much for our prostrated West Indian colonies, condemnation must be the result only of most careful investigation. The Chemical Reporters state that the same benefits may be obtained from the use of innoxious materials and this is actually true.

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CHEMICAL REPORT.

London, June 26, 1850.

Sir—The undersigned have to report the results of a chemical examination, made at your request, of the mode of refining sugar described in the specification of Dr. John Scoffern, of date December 8, 1847, with the view of ascertaining whether the separation of the lead be so effectual that the patent may be used with safety to the public.

In this inquiry we have kept in mind that the process of sugar-refining is conducted on a large scale, and by common workmen, who may not be sufficiently impressed with the necessity of entirely freeing the products, namely, refined sugar, bastards, and treacle, from any trace of deleterious ingredients.

It was found necessary to investigate the following points:—

1. Whether the extraordinary chemical means of discovering lead are applicable and sufficient for ascertaining the presence of minute quantities of that metal, in solutions containing sugar and soluble sulphites, as in the case before us.

2. Whether traces of lead find access to the colonial moist sugar, in its first preparation, or afterwards to loaf sugar, bastards, and treacle, in the ordinary process of refining.

3. To repeat the process of the patent in the laboratory, and test the efficacy of the means recommended for the entire separation of the lead.

4. To inspect a refinery in which the new process was in operation on a large scale, and to examine the refined sugar, bastards, and treacle produced on several different occasions by the new process.

1. It was found by us that lead purposely added to sugar of the new process was much less conspicuously indicated by the hydro-sulphuric acid than it was in a comparative experiment, with ordinary refined sugar, even after the sulphites present in the former were destroyed by means of chlorine. By a modified process, however, described in the appendix to this report, the separation of lead was made easy and complete from both descriptions of sugar, when that metal was present in the smallest appreciable quantity. The sufficiency of our process was tested by repeating the examination of the liquids for lead, after destroying the sugar by fermentation, in a large number of instances.

2. Minute quantities of lead were discovered in an authenticated sample of moist West India sugar amounting to the quantity of metal presented by 0·39 grain of sulphate of lead from one portion of 4 lbs. of this sugar, and 0·19 grain of sulphate of lead from another equal portion of 4 lbs. of the same sugar. The lead was unequally diffused, and it is probable, therefore, existed among the insoluble matters of this sugar, which were considerable.

No lead whatever appeared to be present in four loaves of sugar refined in different operations by the ordinary process, at least so much as is equivalent to one-twentieth of a grain (0·05 grain) of sulphate of lead could not be present in 4 lbs. of any of those samples.

Four pounds of bastards from the same refinery as the preceding loaf sugar gave 1·19 grain of sulphate of lead, and 0·09 grain of oxide of copper in one analysis, and 0·25 grain of sulphate of lead, with 0·07 grain of oxide of copper, in a second analysis—mean 0·22 grain of sulphate of lead, and 0·08 grain of oxide of copper.

Treacle from the same refinery gave in one experiment 0·62 grain, and, in a second, 1·21 grain of sulphate of lead from four pounds—the mean proportion from 4 lbs. is 0·91 grain of sulphate of lead.

It thus appears that a sensible, although it may be a wholly uninjurious proportion of lead, is occasionally present in sugars which have not been prepared by the new process. This lead may be reasonably referred to the use of leaden cisterns and pipes in the ordinary processes of manufacture, and to some extent, also, with the bastards and treacle, to the general practice of painting, with white lead, the inner surface of the metallic cones used as moulds for loaf sugar. The inquiry in regard to the new process becomes thus a question of degree, and not simply of the presence or absence of lead.

3. The directions of the specification of the new process were implicitly followed on three different occasions—the quantity of moist brown sugar operated upon being 2 lbs. in one operation and 4 lbs. in each of the other two operations. The syrup, after the application of the sulphurous acid and chalk, was submitted to the same rigid analysis as the preceding samples of sugar, without the discovery of any trace of lead remaining.

The means directed for the removal of lead appeared thus to be sufficient for that purpose, when applied with the means and attention which the process can receive in a chemical laboratory.

4. By the courtesy of Messrs Goodhart and Co., sugar refiners of Limehouse, who were working under the new patent, we obtained properly authenticated samples of refined sugar of ten different operations,

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with one sample of bastards and two samples of treacle, all produced by the new process.

Four of these loaves were particularly examined, including the two samples which appeared by certain preliminary experiments to yield most lead in the whole series. Four pounds of each sample gave the following proportions of sulphate of lead:

Loaf, No. 3	..	0·10 grain	sulphate of lead.
,, 4	..	0·08	,, ,,
,, 6	..	0·13	,, ,,
,, 10	..	0·10	,, ,,

Lead, therefore, appears to be uniformly present in these loaves; but in a proportion which is quite insignificant, and to which no injurious influence could be justly ascribed.

Three pounds of the bastards, from the lead process, gave 1·37 grain of sulphate of lead.

Four pounds of the treacle gave 5·16 grains of sulphate of lead in one analysis, and 6·32 grains in a second analysis.

Four pounds of the second sample of treacle, which was obtained from Messrs. Goodhart at a later period than the other samples, gave 2.73 grains of sulphate of lead.

The proportion of lead in one of these samples of treacle is sufficiently high to excite apprehensions, if treacle were consumed as lagely and continuously by individuals as sugar is particularly as the metal exists in the state of a soluble salt: but the second sample of treacle gives a considerably less proportion of lead, which was not exceeded in other samples of treacle made by the new process which were obtained from a different source.

On application to Messrs. Evans, of Cork, we were favored with another series of products obtained in refining sugar by the new process, in the manufactory of these gentlemen.

The samples were taken by Mr. Adam Young, of the Inland Revenue, and conveyed to us properly described and labelled. They consisted of six loaves of different operations, two samples of bastard's and two samples of treacle.

Of five of the loaves, four pounds of each gave the following proportions of sulphate of lead:—

Loaf, No. 1	..	0·66 grain	sulphate of lead.
,, 2	..	0.37	,, ,,
,, 4	..	0.09	,, ,,
,, 5	..	No lead.	
,, 6	..	1·05	,, ,,

It appears that the presence of lead is nearly as constant in these samples as in the former, and the usual proportion of the metal is sensibly greater. The metal appeared to be present in both cases, chiefly in an insoluble form.

Tha sample of bastards which was lightest in color gave 0·74 grain of sulphate of lead in one analysis, and 0·72 grain of sulphate of lead in another—mean, 0·73 grain from four pounds.

The sample of bastards which was dark in color, gave 0·42 grain of sulphate of lead in one analysis, and 0·48 grain of sulphate of lead in another—mean, 0.45 grain from four pounds.

Of the two samples of treacle, the lighter colored, which was marked "for consumption," gave 0·87 grain of sulphate of lead from four pounds.

The other sample of treacle of a dark color, and marked "To be passed through bed of charcoal," gave 2·19 grains of sulphate of lead from four pounds.

It appears from the foregoing details that the refined sugar, bastards, and treacle generally acquire a trace of lead from the new process, sufficient to be distinguished by chemical tests.

That the lead found in the refined sugar is minute, the quantity not exceeding that occasionally acquired by the bastards and treacle in the ordinary process of manufacture.

In the bastards of the new process, the proportion of lead is not great, but sensibly exceeds the latter standard.

The lead appears to accumulate in the treacle, but in no case that we have had an opportunity of observing, to such an extent as would justify us in pronouncing the treacle to be poisonous.

The inspection of the process on the large scale satisfied us that the lead may be removed from the sugar to a point beyond danger, provided the operations are constantly watched by a person competent to apply the necessary chemical test of purity to the products.

In conclusion, although our results do not indicate certain and immediate danger from the use of this process in British refineries, still we must deprecate its extension, on the general ground that poisonous substances should never be used in the preparation of an article of food, where they can be avoided; the object effected in this process by means of a poisonous material, the use of which is unquestionably attended with the possibility of grave accidents, being one which is sufficiently attainable otherwise without danger.

THOMAS THOMSON.
THOMAS GRAHAM.
H. W. HOFMANN.

John Wood, Esq, Chairman of the Board of Inland Revenue.

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APPENDIX TO REPORT.—METHOD OF ANALYSIS.

THE sugar was dissolved in several times its volume of distilled water and washed; hydrosulphuric acid in great excess was passed through the solution. The liquid was then mixed with a solution of egg albumen, agitated well, and afterwards heated to coagulation in a porcelain vessel.

The coagulum which contained the lead in the form of sulphide, when that metal was present, was collected on filters which had themselves been previously tested for lead. The filters were icinerated in a muffle, and the ash afterwards fused with a slight excess of carbonate of soda. The fused mess was exhausted with water, and washed till the filtrate was found to be free from sulphuric acid. The insoluble residue from the samples of treacle, containing much sesquioxide of iron, was boiled for half an hour with concentrated nitric acid, and the solution, being diluted with water, was filtered, to separate some iron which was not dissolved. The filtrate, evaporated nearly to dryness, was diluted with water, and was precipitated by hydrosulphuric acid, after being observed to have a decided acid reaction.

The sulphate of lead was collected on Swedish filter paper, incinerated, dissolved in nitric acid, to which some distilled sulphuric acid was afterwards added. After evaporation, the lead was weighed in the form of sulphate of lead. In some cases an appreciable quantity of copper appeared. Then the sulphate of lead and oxide of copper remaining after ignition were separated from each other by means of dilute nitric acid. The nitrate of copper being decanted off, the sulphate of lead remaining was weighed alone. The latter was finally reduced by the blowpipe, and the lead which it contains obtained in the metallic form.

A Return of the Quantity of Treacle consumed by Individuals at the prices herein named:— Ravenhead—

12 persons consumed.....6lbs. per week.
4 ditto ditto .....2lbs. ditto.
Average for each individual ½lb. ditto.

Blakely, Middleton, and Alkrington—

PER WEEK.

In one family 3 children consume 3½lbs.
Ditto do. 3 ditto ditto 3lbs.
Ditto do. 2 adults ditto 2lbs.
Ditto do. 3 children ditto 3½lbs.
Ditto do. 6 ditto ditto 7lbs.
Ditto do. 3 ditto ditto 3lbs.
Average 1lb. and 1-10th each individual.

Bury (Lancashire)—

87 individuals.....32½lbs. per week.
Each individual....0·37351b. ditto.

More consumed in hot weather, when they make what is called "Treacle Hum."

Taking 4lbs. of treacle to contain a quantity of a soluble salt of lead, equivalent to 6·32 grains of sulphate of lead, as shown by the analysis of Professors Thomson, Graham, and Hoffmann, one pound of treacle will contain 1·58 grains of sulphate of lead; therefore according to the foregoing returns, each individual would consume weekly as follows:—

Ravenhead	0·79	grains.
Blakely	1·67	,,
Middleton	1·84	,,
Alkrington	1·75	,,
Bury	0·59	,,
Total.....	6·64	grains.

Average, 1·32 grain for each individual per week; or for the year, 68·64 grains for each person.

Minimum, 30·68 grains; maximum, 95·68 grains per year each person.

G. PHILLIPS,
Surveying General Examiner.
Laboratory, Inland Revenue, July 5, 1850.

London, July 16, 1850.

Sir—In accordance with your request, that we should furnish you with our opinion "as to the safety of consumers of sugar, bastards, and treacle," prepared by the mode specified in Dr. John Scoffern's patent, the undersigned beg to make you the following report:—

As the basis of our opinion we have assumed the accuracy of the statements contained in two papers which you have furnished us, namely, a copy of a report by Messrs. Thomson, Graham, and Hofmann, of the results of their chemical examination of the mode of refining sugar described in the specification of Dr. John Scoffern, of date December 8, 1847; and also a return by Mr. G. Phillips, of the quantity of treacle consumed by individuals of Ravenhead, Blakely, Middleton, Alkrington, and Bury (Lancashire).

From the chemical report it appears that the maximum and minimum quantities of sulphate of lead obtained from refined sugar, bastards, and treacle, obtained by Dr. Scoffern's process, were as follows:—

4lbs.	Maximum.	Minimum.
Refined sugar..	1·05 grain.....	·0 grain
Bastards	1·826 grain	0·42 grain
Treacle.....	6·32 grains	0·87 grain

It further appears from Mr. G. Phillips's return, before quoted, that the consumption of treacle by 123 persons was 62½lbs—

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		lbs. of treacle consumed per week.
Ravenhead	12 persons..	6
	4 „ ..	2
Blakely, Middleton, and Alkrington...	18 children	20
	2 adults..	2
Bury (Lancashire)..	87 individuals	32½
Total.....	123 persons	62½lbs

The maximum and minimum quantity consumed per week is as follows:—

	Maximum.	Minimum.
Treacle consumed per week by one person ..	1·66	0·3735

Assuming, therefore, that 4lbs. of treacle contain a quantity of metallic lead equivalent to 6·32 grains of the sulphate, it follows that the maximum and minimum quantity of lead consumed by one person per week and per year would be as follows:—

Per Week.		Per Year.	
Maximum.	Minimum.	Maximum.	Minimum.
Sulphate of lead consumed—			
1·843	0·590	95·836	30·68

Now, it appears to us that, for the purpose of our investigation, we ought to calculate the effect likely to be produced by a *maximum quantity* of lead taken in treacle.

Our inquiries, therefore, will be directed to the effects likely to be produced by the ingestion of a quantity of lead equivalent to 1·843 grain weekly, or 95·836 grains annually of the sulphate.

We have, however, thought it desirable to calculate in the first place what quantities of metallic lead are equivalent to the above-mentioned quantities of the sulphate. Assuming 152 grains of sulphate of lead to contain 104 grains of metallic lead, it follows that 1·843 grain of sulphate of lead is equivalent to 1·261 grain of metallic lead, and that 95·836 grains of sulphate of lead are equivalent to 65·572 grains of metallic lead.

Our investigation, therefore, practically resolves itself into the inquiry whether 1·261 grain of metallic lead, contained in a salt of lead capable of becoming dissolved by the juices of the alimentary canal, swallowed weekly for probably many months is capable of producing serious injury to health.

We have no hesitation in expressing our decided conviction that the weekly use of less than 1·261 grain of lead would be likely to prove highly injurious to health; and in the course of a few months might give rise to alarming symptoms of poisoning.

Dr. H. Gueneau de Mussey, in his interesting "History of the Case of Poisoning by Lead which lately occurred at Claremont," tells us that the habitual use during seven months (namely, from March to the beginning of October, 1848—of water containing, according to Dr. Hofman's analysis, *one grain* of metallic lead in the gallon, gave rise to alarming and unequivocal symptoms of lead poisoning in thirteen persons (eleven men and two women) out of the thirty-eight inhabitants of the palace. Indeed, four of the patients manifested some symptoms of poisoning after five months' use of the water. This water was used in all culinary and table purposes, and, previously to the discovery of its deleterious character, even in the preparation of tisans and lavements.

We know not what might have been the average quantity of this water which was consumed by each individual daily; but if we assume that each person swallowed daily the lead contained in a quart of water, we should then have a quarter of a grain of metallic lead taken daily, or 1·75 grain weekly, or 38·25 grains in five months (153 days.)

The weekly quantity of metallic lead assumed to be taken in this water is greater than that calculated to be taken in treacle, according to Mr. G. Phillip's return.

At the rate of 1·261 grain weekly, it would take 212 days, or about seven months, to introduce 31·25 grains of lead into the system.

It does not, as we conceive, fall within the objects of this report to enter at length into the symptoms which arise from lead poisoning; but we may observe that the compounds of lead are well known to be most insidious in their action. When swallowed, they are absorbed, and accumulate in the system; hence, when taken in minute doses during a long period of time, they give rise to various alarming symptoms, which may end fatally, unless the cause be withdrawn.

Perhaps the best test which we can apply to the solution of a question of this kind is to inquire whether we by ourselves or our families would knowingly consume an article of food which would have the effect of transferring weekly into our bodies one grain and a half, or even one grain, of a compound of lead. Our answer is, assuredly not. If we could procure the article of food free from such contamination, we should reject that which contained this proportion of lead poison; and if we could not procure it in an uncontaminated state, we should prefer abandoning altogether the use of food which might be attended with injurious consequences to health. Even supposing that there were no facts to show that

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very minute doses of lead poison taken daily for many weeks may seriously endanger health, the risk is too great to be incurred.

For the reasons above assigned, it is our opinion that the treacle produced by Dr. Scoffern's process cannot be used as a daily article of food in the quantities specified in the return, or even in smaller quantities, without exposing those who consume it to the risk of slow poisoning by lead.

GENERAL REMARKS ON THE PROCESS.

The results obtained by the chemical reporters show that samples of sugar, bastards, and treacle, manufactured with the greatest care by persons acquainted with Dr. Scoffern's process, do invariably contain a portion of lead, which is chiefly washed into the treacle. Hence the test and countertest advised in the process are not capable of showing that the sugar is free from lead, even when these tests are employed by experienced persons. If worked by inexperienced persons, a very large quantity of lead may remain in the syrups, and be diffused through the refined sugar, or carried into the treacle. Without the constant supervision of a skilful chemist, the public health would be greatly endangered by the general consumption of saccharine substances so prepared, and even under the supervision it would appear from the analysis of the samples that, while the consumers of refined sugar might possibly escape, the consumers of treacle would be liable to suffer, after the lapse of some weeks or months, from the usual effects of lead poison.

All that has hitherto been said refers to the application of sub-acetate of lead to the process of sugar refining. With regard to the question of its employment in the original extraction from cane juice, we have not the same satisfactory data afforded by quantitative analysis as those which have been supplied to us with regard to the former process. But it appears to us that all which we have said on this subject applies *a fortiori* to the extraction of sugar from cane juice.

Further, if the refining process is carried on, not upon the *ordinary* raw sugars and molasses at present imported, but upon materials *already* charged with a noxious proportion of lead by the introduction of Dr. Scoffern's patent into the first manufacture, it may be fairly anticipated that the proportion of lead in the treacle which is the residue of the double process will be considerably larger than that found in the treacle of the present manufacture.

We are, Sir, yours respectfully,
JONATHAN PEREIRA,
ALFRED SWAINE TAYLOR,
WILLIAM BENJAMIN CARPENTER.

To John Wood, Esq., Chairman
of Inland Revenue.

DR. SCOFFERN'S PROCESS OF REFINING SUGAR, AND THE CUBAN PLANTERS.

THE *Colonial Magazine*, quoting from a contemporary, says:—In reference to the unfounded statements regarding the alleged use of acetate of lead in the manufacture of sugar by the planters of Cuba, our correspondent states that the Representatives of the Spanish Government in foreign countries have been instructed to contradict these rumors in the most unqualified manner. The Government, it was also said, had the intention of prohibiting the introduction of any process of sugar manufacture in which the acetate of lead should be employed. The Havana journals took up the matter very warmly, as being founded on misrepresentation if made in good faith, or else as being an intentional calumny. The planters, as a body, are very averse to the employment of new methods, and few, if any of them, would venture to run the risk of using an ingredient of a deadly nature, the incautious or mischievous application of which might so easily jeapordise their properties and even their estates. The enquiries made by our correspondent lead him to assure us that the obnoxious article is not used by any of the Cuban Planters, and that the attempt made about a year ago to introduce the machinery and mode of sugar fabrication connected with its use, did not succeed.

THE KOUSSO—BANKSIA ABYSSINICA.*

To the Editor of The Lancet.

SIR,—In *The Lancet* of the 29th of June last, I observe a most interesting report of the cases treated by "Kousso," from a clinical lecture delivered by Dr. Budd, on the 31st of May, in King's College Hospital; and as it appears to be a medicine but recently introduced into Europe, and to be hardly attainable there at times, save at a most exorbitant price, I take the liberty of addressing to you the following brief notice of the plant, a sample of which I hope to be able to forward to Dr. Budd, at King's

* *The Lancet.*

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College Hospital, by the next mail, *viâ* Southampton.

In the report above alluded to, I observe that the "Kousso" is called the "Brayera Anthelmintica," from Dr. Brayer, who first introduced the use of the plant, or rather made its virtue known in Europe. On referring to Bruce's travels, vol. vii. Appendix, a minute and accurate description of the medicine is found, as also an engraving of the plant in the volume of Plates. That great and much-calumniated traveller calls it, in testimony of esteem for a friend, "Banksia Abyssinica;" and I submit, with all deference, that as James Bruce was the first traveller who brought the plant into notice, the name given by him ought to be retained.

In the appendix to the second volume of the "Highlands of Ethiopia," by the late lamented traveller, Sir W. C. Harris, the following mention is made of the "Cossoo," by Dr. Kirk, who was a member of the embassy:—

"'Hagenia Abyssinica' ('Cossoo') affords, in a cold infusion of the dried flowers and capsules, the famous drasticum purgans and anthelminticum of the Abyssinians. The tree is one of the most picturesque in appearance."—Vol. ii. p. 414.

In Southern Arabia, on the sea coast, and along the shores of the Red Sea, it is well known, and considered a most valuable medicine. In the Northern and Southern Abyssinia it is universally used about once a month, the trees being numerous, and the medicine costing hardly anything. At Hurrur, a province bordering on the kingdom of Shoa, it is well known, and used; though the Somali tribes, residing to the eastward, on the N.E. horn of Africa, are unacquainted with its virues. Bruce mentions that no Abyssinian will travel without it; and I am informed by my friend Lieutenant Cruttenden, Assistant Political Agent at Aden, that such is actually the case, to his knowledge; the few Abyssinians who visit the port of Aden invariably bring with them a supply. The dose I understand to be a small handful of the flowers mixed with water, in which sometimes tamarinds are infused, the patient, whilst under its effects, keeping far aloof from every one. Its operation is speedy and most effectual.

In a country like Abyssinia, where almost all, if not the entire population are more or less affected with tape-worm, the "Kousso" is a special blessing of Providence, as a medicine within the reach of the poorest shepherd, and infallible in its effects.

Mr. Coffin, an Englishman, for many years naturalized in Abyssinia, and now a chief of some importance, visited Aden a few years ago, and whilst staying with my friend above mentioned, administered a dose of the "Kousso," with the happiest effect, to an officer of H.M. 17th Regiment. Mr. Coffin never travelled without a supply of the medicine, and even during his stay at Aden, took it regularly himself, and administered their customary doses to his attendants who had accompanied him.

I am not aware if the officers of the surveying vessels of the Indian navy, when employed on the coast of Abyssinia and Nubia, used the remedy or not. I believe they did, as I am aware that many of them suffered greatly from tape-worm; and one of the party, although eighteen years have elapsed, is not free from the disease even at the present day.

On making inquiries in the Aden bazaars, I had no difficulty whatever in finding the plant. The Arabs, indeed, fortunately for them, are almost free from the disease that so afflicts their Abyssinian neighbours; but it is kuown to them as a purge. The specimens brought from the bazaar are decidedly inferior, and so old, that I conceive the flowers must have lost a considerable portion of their virtue. I do not, therefore, send any of that; but a native has despatched an order to Massowah, the port of Abyssinia, for a supply, which I shall not fail to forward to England, by the earliest opportunity. I feel sanguine of being able to procure a regular and constant supply in a short time, at a very cheap rate, through the medium of two Abyssinian youths, formerly educated in Bombay, and now residing with their father near Adowah. The sample now in my possession has been obtained from this source. I am not yet aware of its cost, but I am confident that even were it sent overland from Aden, it would not prove an expensive medicine.

You are at full liberty to make any use you please of this communication. Should through my agency, the use of the plan become more generally known, it will afford me sincere pleasure; and if there are any other points relative to the plant, on which you require information, I shall be most happy to furnish them, so far as lies in my power.

I remain, dear Sir, yours faithfully,

JAMES VAUGHAN, M.R.C.S.L.

Assitant-Surgeon Bombay Army; Port and Civil Surgeon, Aden, Arabia Felix.

Aden, Aug. 7, 1850.

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KOUSSO IN TÆNIA.*

To the Editor of The Lancet.

SIR,—Seeing in your journal that Kousso has been tried in England for the extermination of tænia, I beg to add the result of two or three cases. The first was that of an Englishman who has been domesticated in Abyssinia, and after a year's residence in the country, was attacked with tape-worm; the medicine taken was Kousso, which had the effect of giving him two months' freedom from them, but at the end of that time they returned, and continue to do so unless a dose of this medicine is again taken. Removal from the country has not eradicated them, and on this man's return to Abyssinia, when I saw him, he was suffering from them, until a respite was obtained by having recourse to the usual dose at breakfast, sufficiently to produce giddiness and nausea, followed by purging, when he voided a live worm, upwards of a foot in length. This is an almost universal complaint of the country, and the Kousso is the remedy generally used; but four or five other vegetable substances are also taken, of more or less power, and possessing similar properties. The production of this worm is by some attributed to the water, by others to the eating of raw meat, which, together with grass (?) may not be improbable. The scarcity of salt is another imputed cause.

I procured some Kousso from Abyssinia, and gave a large dose of it to a patient; the effect was, after considerably affecting the head, stomach, and bowels, the evacuation of fragments of tænia, and a whole worm, said to be a fathom in length. I saw, however, two which had passed from him, the smaller one having a shape and size similar to that of a leech, and of a whitish membranous color. He remained quite free from them for six months, when I began to think him cured, but unfortunately they returned.

Apparently this remedy promises extermination no more radically than pomegranate. Should it prove otherwise, the few native traders at Massowah would, after some time, doubtless export it, at a price within reach of those who commonly suffer from that complaint.

I have the honor to be, Sir,
Your obedient servant,
JAMES DAUBENY.

Bombay, July 24, 1850.

* *The Lancet.*

SEEDS EMPLOYED IN TROPICAL AMERICA AS A REMEDY FOR THE EFFECTS OF THE BITE OF SERPENTS.

BY M. JOMARD.

M. HERRAN, chargè d'affaires, in France, of the Republic of Costa-Rica furnished me with a few seeds from a tree called in the country *cedron*, which grows on the elevated plains of the Cordillera of the Andes. The property which is attributed to this seed, as a powerful antidote to the bite of the most dangerous serpents, appears to be of a nature to attract attention, and M. Herran wishes it to be subjected to the experiments necessary for ascertaining its efficacy. I think it my duty, therefore, to transmit to the Academy the seeds supplied to me by M. Herran, as well as the following extract from a letter which he wrote to me on leaving:—

"It was only in 1828 that the savage Indians brought to the market of Carthagena some seeds of the cedron. To demonstrate its infallible virtue, they caused animals and themselves to be bitten by the most dangerous serpents, called toboba, mountain coral, &c.; the promptitude with which the poison was neutralised was so miraculous that the seed sold at a very high price.

"During my long stay in central America, I had occasion to resort to the seed of the cedron in eight different cases. The following is the mode in which I employed it:—

"5 or 6 grains of this seed were rasped; this powder, mixed with a teaspoonful of brandy, I caused the patient to swallow: I then sprinkled with it a piece of linen steeped in brandy, which I applied to the wound; this done, I left the patient to repose, and I have rarely had occasion to repeat the dose to cure him radically.

"I have also employed this medicament with success in cases of remittent fevers which had resisted the employment of sulphate of quinine."

POISONING BY CAMPHOR.†

BY M. SCHAAF.

THE common and often irrational use made of camphor, induces us to publish the following observations.

* *Comptes Rendus*, No. 5, July 29, 1850.
† *Journal de Chimie Médicale*, Sept., 1850.

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On the 8th of April, 1850, at 7 o'clock in the morning, the wife of a man named Boyer, an innkeeper at Neudorf, near Strasburg, gave to her two sons, one aged five and the other three years, and to her little daughter aged eighteen months, a dose of powdered camphor amounting to half a teaspoonful each, or about 2 grammes.

Camphor had been given to them several days in succession, but in smaller quantity, and never fasting; as a vermifuge for the two boys, and to remedy an intestinal derangement in the little girl. It had been administered by the advice of neighbors, who were enthusiastic in their praises of the magical virtues of this odorous substance.

The first symptom which the parents observed was excessive pallor of the face, and with a fixed and stupid look. Next, slight delirium, burning in the throat, and thirst were experienced. These symptoms were followed by nausea, vertigo, and slight contractions of the face. Then came vomiting and convulsions, with loss of consciousness, with frequent desire to make water. All this was related to me by the parents on my arrival, half an hour after the camphor had been swallowed, and these same effects were produced in all the children with only slight variations.

I was struck with sight of these three little creatures, in violent convulsions, with the features distorted, the face livid, and incessantly vomiting.

The eldest, more than the others, was seized with clonic convulsions, with intervals of a few seconds, sometimes of a minute. The upper extremities were more agitated than the lower. The body often drew itself into a ball, and extended itself again with great rapidity. I had never had an opportunity of witnessing such a phenomenon.

The face, alternately pale and flushed, was the seat of incessant spasmodic motions: the eyelids, which were perpetually agitated and half closed, enabled me to see that the eye-balls were convulsed up and down. A little foam pressed out between the clenched teeth.

The skin appeared to me generally pale and humid, and the heat of the leguments diminished. Occasionally, there was a complete loss of consciousness; at other times the patient returned to himself, and obeyed the directions given to him. The respiration was short and loud; the pulse impalpable, especially on account of the agitation of the subject.

Heaving, soon followed by vomiting, owing to the employment of remedies, was frequent, as were the alvine and urinary dejections.

The urine appeared to me to possess the odor of camphor, although this has been denied.

The whole of these symptoms continued with more or less intensity for three consecutive hours; a comatose sleep then supervened, which lasted until evening. He passed a good night, and, beyond a little uneasiness, there were no bad symptoms next day.

As to the means employed for combatting these poisonous effects, not being acquainted with any acknowledged antidote for camphor, I commenced by driving the enemy away by all possible means; I administered an emetic, laxatives, emollient, oily and narcotic enemata, and, finally, an opiate draught. I said within myself, in regard to the latter, that as, in certain cases, camphor is employed as a remedy for the symptoms induced by opium, the latter, in its turn, should moderate the action of camphor. However, these formidable symptoms were comparatively very quickly dissipated.

I must not omit to state that the first vomiting did not take place until nearly an hour after the camphor had been swallowed; consequently, there was plenty of time for absorption.

The second child presented the same symptoms as his brother, but with much less energy. He vomited sooner and spontaneously, and thus owes, although of a weaker constitution and younger, to this circumstance, his more speedy restoration to health. Indeed, in an hour and a half after the appearance of the illness, a profound sleep, accompanied by profuse perspiration, easily restored and established his health.

It now remains for me to speak of the little girl, who paid with her life for the deplorable error of her parents.

Delicate, and backward for her age, she was suffering from difficult dentition; and afterwards a very serious affection of the respiratory organs had supervened, which had even excited convulsive symptoms. But her health had recently improved, and the few flutuosities and want of appetite, which had been the pretext for the administration of the camphor, were in reality of no consequence.

She was the first who exhibited the symptoms of poisoning. From the commencement of the illness to the end, she never recovered consciousness; the convulsions, which were less violent than those of her eldest brother, continued without interruption from 7 o'clock in the morning until 2 o'clock in the afternoon, when she died in a crisis.

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ON COLD WATER AS A SOLVENT OF THE ACTIVE PRINCIPLES OF DRUGS.

BY MR. RICHARD BATTLEY.

In the preparation of medicines there are a few points to which I have especially directed my attention, and to which I shall take this opportunity of inviting your attention, believing that the conclusions to which I have come, suggest the general introduction of a new form of medicine, and of an important alteration and improvement in one now in common use.

1. The superiority of cold to boiling water as a menstruum for nearly all vegetable substances.

2. The quantity of water to be employed.

3. The extent to which the evaporation of the product can safely and advantageously be carried.

I. The object of the various menstrua employed, as hot and cold water, spirit, ether, vinegar, &c., is, of course, to dissolve the active principles with as little as possible of the inert constituents, which not only do not improve, but frequently greatly impair the properties of the medicine. I believe that I have employed cold distilled water for this purpose far more extensively than has been customary in this country or elsewhere; but the Edinburgh and Paris Pharmacopœias, have, in the last editions, adopted it to a much greater extent than formerly. The advantages of cold water, that is, of water at the ordinary temperature of the laboratory, say 60 to 65° F., are, first, that it dissolves from the tissue of plants, in two or three macerations, all or nearly all the active principles soluble in boiling water, spirit or ether, taking up even resin abundantly when mixed with gum, the possibility of which, even out of the tissue, was long ago shown by Dr. Babington; secondly, that it does not dissipate, but retains the volatile matters, and, thirdly, that it leaves behind the starch. Extracts prepared from such infusions are more aromatic, more transparent, more soluble, and less liable to decomposition. If it be objected that the produce is often considerably larger when the boiling temperature is employed, I admit it. So also is the bulk of scammony when adulterated with flour and chalk. But virgin scammony has not a greater superiority over the adulterated drug than has the high flavored, soluble, translucent product of cold maceration over the nauseous, half soluble, hard opaque, starchy extract prepared by boiling.

II. The quantity of cold water is also important. I have been led to adopt as a rule for the maceration of most substances, twice their weight of cold distilled water, adding for each subsequent maceration as much distilled water as the amount of infusion previously drained off or expressed. To be thoroughly saturated with the small quantity of fluid, the article must be coarsely powdered, bruised, or cut into small pieces, and repeatedly pressed into the fluid with a rammer or with the hand. The specific gravity of the fluid seldom increases after four or six hours maceration. In some cases, as roots, leaves, hop, colocynth, &c., strong pressure is absolutely necessary for displacing the fluid: but in the case of barks coarsely powdered, three-fifths of the fluid will generally drain out without pressure, if time be allowed. If a larger quantity of water is employed in maceration, the additional matter taken up is chiefly gum and other inactive principles, and the medicine is both weakened and impaired by their addition, and is liable to become further deteriorated by the longer continuance of the heat required to get rid of the superfluous water.

III. To preserve watery extracts and for the convenience of exhibition, it has been customary to reduce them to a pilular consistence. To this there are serious objections. Extractive matter is rendered less soluble by the separation of its water, and by the heat required for its evaporation, and the constituents, by being brought into close contact, form new and often very insoluble compounds, and continue to do so long after the completion of the extract, until the properties and value of the medicine are materially changed. To guard against these changes and to preserve the solubility of the extractive matter, I introduced, in 1818, the form of liquor, or inspissated cold infusion, evaporating the cold infusion at a temperature not exceeding 160° F., to the sp. gr. of 1200, and afterwards, to preserve this liquid extract from decomposition, adding to it as much rectified spirit as will reduce the sp. gr. to 1100.

These liquors, of which I have prepared about 20 kinds, have been largely employed for many years, and the constant demand for them may be offered as evidence of the satisfaction they have given, of which satisfaction I have also received from all quarters the most ample assurance.

Believing, then, confidently, that cold water is capable of producing the most elegant and useful preparations of mineral

* From the Pharmaceutical Journal, Sept. 1850.

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substances, I am very anxious to impress on you the conviction to which I have been led by the constant superintendence of the operations of the laboratory, conducted under my own eye, and mostly by my own hands.

Should this form of medicines hereafter be adopted into the Pharmacopœia, it will be found that though the process is extremely simple, much care and attention are necessary to produce the proper result. Above all, the evaporation should be conducted at a temperature not exceeding 160° F., and continued until the specific gravity reaches 1200, in order to secure the same uniformity in the result which is obtained by reducing the extract to pilular consistence. The evaporation of the infusion to a definite quantity would have a very different result; for one sample of a drug will often yield to water two or three times as much as another.

ON THE AIR AND WATER IN TOWNS, AND THE ACTION OF POROUS STRATA ON WATER AND ORGANIC MATTER.

BY DR. R. A. SMITH.

It is a matter of immense importance to find from what source it is best to obtain water for large towns, and how it is to be collected. To these points Dr. Smith particularly directs attention.

Regarding the conditions of many springs, which never become muddy, but possess a constant brilliancy and a very equal temperature at all seasons of the year, the author thinks that there is a purifying and cooling action going on beneath. The surface water from the same place, even if filtered, has not the same brilliancy; it has not the same freedom from organic matter, neither is it equally charged with carbonic acid or oxygen gas,—there are, therefore, other influences at work. The rain which falls has not the purity, although it comes directly from the clouds; it may even be wanting in cleanness, as is often the case.

Springs rise through a great extent of soil, and collect a considerable amount of inorganic salts; and it is shown by Dr. Smith that their purity is due entirely to the power of the soil to separate all organic matter, and at the same time to compel the mixture of carbonic acid and oxygen. The amount of organic matter removed in this way is surprising, and it is a most important and valuable property of the soil.

The change takes place even close to cess-pools and sewers; at a very short distance from the most offensive organic matter there may be found water having little or none in it. As an agent for purifying towns, this oxidation of organic matter is most extraordinary, and we find the soil of towns which have been inhabited for centuries still possessing this remarkable power. St. Paul's Churchyard may be looked upon as one of the oldest parts of London, and the water from the wells around it is remarkably pure, and the drainage of the soil is such that there is very little of any salts of nitric acid in it.

If the soil, says Dr. Smith, has such a power to decompose by oxidation, we want to know how it obtains so much of its oxygen. We must, however, look to the air as the only source, and see how it can come from it. When water becomes deprived of oxygen, it very soon takes it up again,—as may be proved by experiment. This shows us that as fast as the oxygen is consumed by the organic matter it receives a fresh portion, conveyed to it by the porous soil.

Several experiments of the following character were adduced, to show the filtering power of the soil. A solution of peaty matter was made in ammonia; the solution was very dark, so that some color was perceived through a film of only the twentieth of an inch in thickness. This was filtered through sand, and came out perfectly clear and colorless. Organic matter dissolved in oil of vitriol was separated from it by a thickness of stratum of only four inches. A bottle of porter was by the same process deprived of nearly all its color. The material of which this filter is made, is of little importance. One of the best, according to Dr. Smith, as far as clearing the water is concerned, being of steel filings; oxide of iron, oxide of manganese, and powdered bricks, all answering equally well. This shows that the separation of the organic matter is due to some peculiar attraction of the surfaces of the porous mass presented to the fluid. This paper was a continuation of Dr. Smith's Report published last year,—and he purposes pursuing the inquiry.

NOTE ON DR. GREGORY'S PROCESS FOR PREPARING PURE CHLOROFORM.*

BY PROFESSOR CHRISTISON.

The process proposed by Dr. Gregory in the May Number of this Journal for pre-

* From the *Monthly Journal of Medical Science*, September 1850.

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paring a perfectly pure chloroform, has given occasion to various notices in contemporary journals, some of them laudatory, and others the reverse. Among the latter may be mentioned the statement of a late writer in the "Pharmaceutical Journal," that chloroform prepared in Edinburgh, avowedly by the process in question, was found, in Liverpool, to have undergone decomposition, to have become loaded with chlorine, and to be quite unfit for use. In Dr. Gregory's absence on the continent, I have felt it to be my duty to make inquiry into the truth of this statement; and the result is, that no less than three manufacturers in Edinburgh have tried the process on a considerable scale, and that all have failed to obtain a permanent article. A chloroform of fine quality is obtained in the first instance; but it does not keep many days; and ere long it becomes so loaded with chlorine that its vapour cannot be inhaled.

I have not had time to investigate fully the cause of this unexpected phenomenon, or to ascertain whether it is an inherent fault in the process, or depends rather on some manipulation having been practised, or left out, which Dr. Gregory may have neglected to particularise. But this much seems certain,—1. That chloroform purified by one treatment, with pure sulphuric acid, free of nitrous acid, keeps perfectly; 2. That such chloroform, if left in contact with ordinary sulphuric acid, containing, as it generally does, an impregnation of nitrous acid, will, in less than twenty-four hours, undergo decomposition, and afterwards rapidly evolve chlorine; 3. That if a drop or two of nitrous or common nitric acid be added to an ounce of pure sulphuric acid, the decomposition goes on with far greater speed; 4. That if the sulphuric acid be carefully freed of nitrous acid, so as not to affect solution of green vitriol, no change may occur in the chloroform for an entire week; 5. But that, nevertheless, even with pure acid, decomposition begins at last, so that in four weeks, the odor of chlorine is intolerable. It therefore seems probable, that the best chloroform cannot resist the protracted contact of sulphuric acid; and that even the repeated action of that acid—for example, when used to affect thorough purification, according to the method of Dr: Gregory, produces some change, which, though inappreciable at first, gradually leads to decomposition in the end. Why this happens, whether it always happens, or in what circumstances, are questions which we are not prepared to answer. It is probable, however, that Dr. Gregory will be able ere long to do so satisfactorily; for there is a specimen of chloroform in his laboratory, which was prepared six months ago hy his process, and which is still quite unaltered. Meanwhile, it is obvious that manufacturers ought not to adopt that process until farther explanations shall have been given. It may be added, that the Edinburgh manfacturers have recalled from their customers the chloroform which had been manufactured by the repeated use of sulphuric acid; and that the spurious article is very easily known by the pungency which is added to the purely etherial odour of the uncontaminated preparation.

ON THE STAINS OF CEREBRAL MATTER DEPOSITED ON TISSUES.*

In a recent work, Professor Orfila established, by comparative experiments, the microscopical and chemical characters presented by the stains of cerebral matter on tissues; to these characters, which cannot fail to be of great value in medico-legal investigations, we will add those which we have discovered, and which in some measure corroborate those of M. Orfila. It is known that Vauquelin demonstrated that the cerebral and nervous substance furnished, by calcination, phosphoric acid arising from the combustion of the small quantity of phosphorus contained in the phosphuretted fatty matter of these tissues; it appeared to us that this fact might be of some value in the examination of the stains: after several direct experiments executed on these stains, we are of opinion that this character, united to the foregoing, will enable us to arrive at a still more accurate conclusion.

Small portions of dried cerebral matter extracted from some stains deposited on a tissue of white linen, are capable of giving, independently of the reactions with concentrated sulphuric acid, by calcining them in the air in a small platinum capsule, or on a plate of the same metal, an acid charcoal which distinctly reddens blue litmus and the washing water of which precipitates the lime in lime water in white gelatinous flakes. This experiment always gives the same result in operating even on a small quantity of dried cerebral matter of the size of a grain of millet, or of the weight of 0·010 gramme to 0·015 gramme.

It is sufficient to carbonise the matter slowly in the air, by gradually heating in the flame of a spirit lamp, to avoid as much as possible the combustion of the combus-

* *Journal de Chimie Médicale, Sept.*, 1850.

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tible gases which are disengaged, and to expose the charcoal formed to a dull red heat. If, after having detached the charcoal from the platinum capsule or plate, it be bruised with a glass tube, and treated with a few drops of distilled water, which must be heated and reduced to a smaller bulk, it will be found that this liquid reddens litmus paper, and renders lime water turbid, giving a white, gelatinous precipitate of subphosphate of lime, which salt may be redissolved in hydrochloric acid and precipitated again by supersaturation with liquor ammoniæ.

This mode of operating, practiced on other organic tissues of mammiferous animals, will furnish a neutral or alkaline charcoal. However, the cerebral substance is not the only tissue of the animal economy which contains phosphorus in a peculiar state of combination. Vauquelin has demonstrated that the soft roe of the carp and the eggs of some other fish produce, on being carbonised, a certain quantity of phosphoric acid.

SYRUP OF CASTOREUM.*

COMPOUNDED BY M. LEBROU, PHARMACEUTIST AT PARIS.

This syrup, of which, says M. Lebrou, practice has daily proved the usefulness in spasms, asthma, spasmodic cough, nervous colic, menstrual colic, hysteria, and neuralgia is composed as follows:—

	grammes.
Distilled valerian water....	1,000
Distilled cherry laurel water	500
White sugar.....	3,000
Castoreum	75
Alcohol at 30 degrees.....	q. s.

Macerate the castoreum in the alcohol for eight days; filter the resulting tincture; add the hydrolates; digest the mixture in a gentle heat for some hours; let it cool, and filter it. Finally, melt the sugar in the liquor in a covered vessel, and again filter.

* *Bulletin de Thérapeutique.*

PILULÆ SODÆ ARSENIATIS COMPOSITÆ, AND UNGUENTIUM SULPHURIS HYPOCHLORIDI COMPOSITUM.*

BY ERASMUS WILSON, ESQ., F.R.S.

PILULÆ SODÆ ARSENIATIS COMPOSITÆ.

℞ Soda arseniatis, gr. ij., solve in aquæ distillatæ, q. s.
Pulv. guaici., ℈ss.
Pulv. antim. oxysulphureti, ℈j.
Mucilaginis acaciæ, q. s. Misce bene ut ft. pil. xxiv.

UNGUENTIUM SULPHURIS HYPOCHLORIDI COMPOSITUM.

℞ Sulphuris hypochloridi, ℥ij.
Potassæ subcarbonatis, gr. x.
Aclipis purificati, ℥j.
Ol. Amygd. essent., mx. M. ft. unguentium.

* *Pharmaceutical Journal.*

IV. REVIEWS, NOTICES OF BOOKS, &c.

REVIEW OF THE REPORT OF THE GENERAL BOARD OF HEALTH ON THE SUPPLY OF WATER TO THE METROPOLIS CONTAINED IN A REPORT TO THE DIRECTORS OF THE LONDON (WATFORD) SPRING WATER COMPANY. By S. C. Homersham, C.E. London: John Weale, 59, High Holborn.

The substance of this pamphlet is an attack on the Report of the Board of Health, in so far as such Report militates against the interests of the company of which Mr. Homersham is the engineer. As the author has written with that idea uppermost in his mind, he has been led, unconsciously no doubt, into exaggerated counterstatements which materially weaken the effectiveness of his attack on the many delinquencies of the report in question. Mr. Homersham has, however, pointed out some mistatements which go far to weaken the character of the report, as a document, the calculations of which are worthy of credit. The following extract relates to the great soap question:—

"First as to the waste in soap, the Board gives out (page 284,) that 'by the use of soft instead of hard water, the ex-

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pense of soap will be reduced one-half.' In page 77 of the report we find them cite the estimate of Professor Clark as 12,000 tons of soap per year, and another estimate, by Mr. William Hawes, at 20 per cent. less, or 9,600 tons per year; which lesser estimate the Board seems to think should be increased, because, as they say, 'It must at the same time be observed, that a proportion (probably a large one) of the clothes worn in the metropolis are washed at places some distance from it.' Taking the larger estimate at £45 per ton, the annual cost of soap will be £540,000 taking the lower estimate at the same price, it would be £432,000. As the Board have indicated their impression that the lower estimate is too small, and made no stricture on the higher estimate, we may assume, in round numbers that £500,000 must have been understood by them to be near the present annual expense of soap for the metropolis. It follows that £250,000 worth of soap is the Board's estimate of the annual saving that would arise from the use of soft water instead of the present waters.

"Allow me your patience while I endeavour to test the accuracy of this estimate of the saving to be effected in soap.

"The saving in soap from the use of a given softer water will depend on the quantity of water made use of along with soap. Professor Clark gives as the whole average quantity of water likely to be made use of for the washing of clothes where the supply of water is copious, as about 400 gallons per head per year, including, of course, men, women, and children. Now, it is well known that, where soft water is made use of, rather less than the half of the water is consumed along with the soap, and rather more than half in rinsing the clothes. I may assume, then, that 160 gallons of water per head per year is made use of along with soap, so as to require more or less soap according as the water is more or less hard, and the remaining 240 gallons out of the whole 400 gallons in merely rinsing. I may further assume an estimate that seems to be adopted by the Board (page 72) that while 100 gallons of the hard water will consume 30 ounces of soap before producing a lather, 100 gallons of the soft water will take only ten ounces. The saving in soap by soft water will thus be 20 ounces per 100 gallons of water made use of along with soap. But as 160 gallons have already been assumed as the quantity of water that is consumed along with soap per head per year, it will follow that 32 ounces, that is 2 lbs. of soap, is the quantity likely to be saved per head per year, by the substitution of soft water for the hard in the washing of clothes. Perhaps the additional saving in washing the person may be taken at ½ lb. Altogether 2½ lbs., or about one shilling's worth of soap per head per year, which taking the population as about two millions, would come to £100,000 a-year, as the saving in soap for the whole metropolis. But this estimate must be very uncertain. On the one hand, it should be increased on account of the average amount of washing being considerably more in London than in the kimgdom at large, and, on the other hand, it should be diminished, first, on account of the hardness of the water being reduced by boiling; and second on account of part of the water being softened by means of soda. Little or no money-value should be attributed to this second deduction, because, with no more knowledge than is possessed in laundries, soda may be employed so indiscreetly as to cost more by injury to clothes than, than it will save in soap. Professor Clark gives a hypothetical estimate of the value of the soap that would be saved in the metropolis, by the use of soft water, at £63,000. If we take his estimate to be an unexaggerated and a safe one, what shall we say of the estimate of the Board, which comes to four times as much."

With respect to the estimated saving of £250,000 in tea and cooking, arising from the use of softer water, it is remarked,

"Compared with the waters of the present Companies, the water of the Board, lying between 3¾ and 6 degrees of hardness, cannot be softer for infusing tea, or for cooking, than water of the Thames, the Lea, or the New River, which after being boiled, lie between 3 and 4 degrees of hardness, and I need hardly state to you, although it will perhaps not be superfluous information to the General Board of Health, that tea can only be made with boiling water. Nor compared with the projected supplies of the new Companies can it be softer than the water that would be introduced by the Maple-Durham, or the Watford spring water schemes, which would bring in water to the consumers at 4 and 3 degrees of hardness, and producing no deposit of fur on boiling. Supposing, then, the Board had stated the facts of the case honestly and fairly, where would have been the foundation of their estimate of this second annual saving to the community of £250,000?"

But Mr. Homersham seems to forget that if the 16° of hardness of the Thames, Lea,

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and New River, or the 17° of the Watford water are reducible to 3° and 4° of hardness by boiling, it is probable that the 3¾° water of the Board will be reduced to 1° or less by boiling. And it need hardly be stated to Mr. Homersham, that boiling water is as much required for tea, if it be supplied by a public Board, as by a private Company.

The following extract is worthy of more consideration than the subject generally obtains :—

"Many streams, specimens of which collected in cold winter or spring weather, might be pronounced excellent water for domestic purposes, are wholly unfitted in summer and autumn for such uses; which arises not only from the large amount of organic matter contained in them at those seasons, but from the tendency that such matter then has to decompose. As to mineral matter they frequently contain only from 2 to 3 grains per gallon.

"The Board notwithstanding do not mention either the season of the year or the temperature of the specimens of water collected for examination by them, and treat the presence of organic matter in water as of secondary importance; so much so, they have never once mentioned whether the river water they mean to use has much or has little organic impurity. On the face of the Report, indeed, it appears, that neither have they caused the waters they recommend to be examined in summer or autumn, nor does it seem to have occurred to them that such examination is essential to a safe and prudent choice of river or surface water."

Mr. Homersham compares the General Board of Health with the British College of Health.

"Alike unqualified for what they undertake, by professional education or scientific knowledge, they agree in their detestation of the regular practitioner."

This detestation is exhibited in a most marked and insulting manner throughout the whole Report.

The two institutions puff alike. The Board of Health puff off their water at 2*d.* per week per tenement.

"The conspicuous decoy price of the Board for 75 gallons of water per day per house at 8*s.* 8*d.* per year; their *invisible addition* is a permanent rent charge of 19*s.* per house per year for the purchase of the works of the existing Companies; the *real price*, if the Board succeed in duping the Government and Parliament, and do not bring upon the ratepayers more expense than they promise will be £1. 7*s.* 8*d.* per house per year for 75 gallons per day; probably not far from what they now pay to the Companies for twice the supply."

The amount of this 19*s.* is found by assuming the market value of the plants of the present companies to be 6½ millions sterling. This estimate is open to dispute as to its amount, but not as to its necessity.

Amongst the appendices is one respecting the manner in which evidence is manufactured to suit the ends and intentions of the examiner. Those who have been examined before commissions on which Mr. Chadwick sits, are well aware of his peculiar tact in getting *answers* to suit his purposes, without giving the witnesses the opportunity of contradicting or showing the utter fallacies of the question. It is to be feared that there has been too much of this in some of the *recent* sanitary enquiries, though at the same time we would do justice to the remarkable industry and talent exhibited in the conduct of the earlier investigations.

In an Appendix the author points out that the above view of the Soap question has been taken even too moderately :—

"After the text of my Report is in type, I observe in p. 321 of the Board's Report that they say, 'The saving in soap from the use of soft water, in the operation of washing . . . . . would be probably (on the population of the metropolis) equivalent to the whole of the money expended at present in the water-supply.' From which we infer, that about £400,000 worth of soap is saved. Now since, according to the Board, p. 284, one-half of the soap is saved, the whole soap consumed would be £800,000 worth, according to the Board, or but a little above one and a half of the higher quantity, £540,000, or double the lower quantity, £432,000, given in evidence to them. The careful reader will not fail to observe, that the saving in soap, according to the Board, is very near equal to the whole soap now consumed, according to so excel-

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lent a practical authority as Mr. William Hawes, (£432,000)."

There is a separate article on the terms "soft" and "hard" water. He says "water may be *soft* and free from organic matter, and yet from the presence of a large quantity of alkaline salts, be unfitted for nearly all domestic uses."

"The term *hard* water is equally indefinite as *soft* water. 'Hard' water may be 'hard' from holding in solution (as explained in the body of the Report) a certain amount of either lime salts or magnesian salts, and the character of a lime salt, or magnesian salt, again varies according as it may be combined with carbonic acid, on the one hand, sulphuric acid, nitric acid, or any other acid, on the other hand. The quality and adaptation of a 'hard' water for domestic purposes is very different, according as it may be 'hard' from the presence of magnesia or lime, or of both these salts; so that it is only by knowing the amount and character of the mineral matter from which a water derives its 'hardness' that its wholesomeness or unwholesomeness, and its adaptation for domestic purposes, can be predicated.

"Again, 'hard' water may be contaminated, especially when warm, with excremental or organic matter in solution, although it is not so readily poisoned with these impurities as 'soft' water when free from alkaline salts.

"To give a practical illustration: spring water derived from wells sunk in the chalk, the bottom of which are *above* the level of the sea, contain in solution about 21 grains of saline matter per gallon, 18¼ grains of which are bicarbonate of lime, and less than one-half of a grain of carbonate of magnesia. This water, by mere exposure to the air in deep reservoirs, parts with a portion of the carbonic acid, which enables it to hold lime in solution, and thus without difficulty loses in ten or twelve days 4 or 5 grains of lime per gallon, and although it is even then what is popularly termed a 'hard' water, it is admirably adapted for most domestic purposes. It is an excellent water, and most highly esteemed by the inhabitants supplied with it for *drinking* purposes, owing to its *entire freedom from organic impurity* and the *wholesome* character of its chief saline constituent—bicarbonate of lime. It is also *admirably* adapted for making tea, perhaps *excelling any other water in this respect*."

THE COMMERCIAL HAND-BOOK OF CHEMICAL ANALYSIS; OR, PRACTICAL INSTRUCTIONS FOR THE DETERMINATION OF THE INTRINSIC OR COMMERCIAL VALUE OF SUBSTANCES USED IN MANUFACTURES, IN TRADES, AND IN THE ARTS. By A. NORMANDY. London: G. Knight and Sons, Foster Lane, Cheapside.

THIS is a book which will be found useful to that class of persons whose occupations require them to be in possession of the knowledge of the intrinsic or per-centage value of the various articles of commerce which are bought and sold by sample.

This work cannot be said to contain anything new, and is not without its defects, but still we think that the purchaser of it will often find it useful to him, and therefore we recommend it to the notice of the public.

It is an error to suppose that any man thoroughly occupied with commercial pursuits should, by the aid of this or any other work of the kind, be enabled to analyse the various compounds of which it treats, in a manner satisfactory to himself or even fair between the parties concerned; for commercial analysis requires, as much as scientific analysis, that practice and thorough acquaintance with chemical principles, without which such analysis would be worthless. These investigations are always best left in the hands of those whose everyday occupation it is to perform them.

We think that a perusal of this book may be advantageous to dealers and the public, by placing them in possession of the general facts, and by showing them that when such analyses are honestly and properly performed they are unerring and worthy of public confidence.

As a specimen of the general style of the work, we extract the following:—

COFFEE.

1. The principal species of coffee are the Mocha or Turkey coffee, Jamaica, St. Domingo, Cuba and Porto Rico, Berbice, Demerara, Bourbon, Martinico, and Hayti. All species of coffee improve by keeping; coffee is in the best condition when two or three years old.

2. The physical characteristics of coffee are the following. The beans or berries should be of middle size, soft and rounded, of a greenish color, free from impurities, and they should not have the slightest odor of mouldiness, or any other odor, for the berries of coffee absorb most readily the effluvia from other bodies, and thus acquire an unpleasant flavor. Many cargoes of

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coffee have been spoiled from having been shipped with, or even been put into vessels which had previously been freighted with sugar. A few bags of pepper are sufficient to spoil a whole ship-load of coffee.

3. Coffee, even that of the very best quality, and in the best condition, may be impaired by improper roasting, which operation is one of some nicety, and seldom well performed. If roasted too little, the aroma of the coffee will not be fully developed, and the best coffee may then yield a vapid or effete infusion, of a *green* flavor; if roasted too much, the aroma of the coffee is dissipated, and the infusion will have a flat, bitter taste.

4. Coffee, after having been roasted to the proper degree, should be emptied whilst hot in wooden boxes, furnished with sound and well-fitting covers, and it should be kept therein until cold, and not emptied in an open hurdle, to which a see-saw motion is given in order to cool it rapidly as done in England. If roasted in small quantities, it may be emptied in a sheet of brown paper, and the whole wrapped up in a blanket of flannel until cold, the same sheet of brown paper being kept for that purpose.

5. Roasted coffee should be preserved in well-closed and perfectly dry vessels. The berries when properly roasted are of a full and rich brown color, bright and oily superficially.

6. Coffee in grains, that is, unground, may be of inferior quality, or it may have been spoiled by contact with other substances, as we said, or damaged by seawater, but as the berry itself cannot be adulterated, damaged coffee can be directly detected, merely by smelling or chewing a few of the beans. But when ground, the case is different, and coffee may then be, and in fact *is*, adulterated to an enormous extent, by an admixture of pulverized plants or roots previously roasted, such as *succory* or *chicory root*, (cichorium intybus of Linnæus,) *beet root*, *carrot*, *parsnip*, *madder root*, *roasted beans, corn*, *peas*, &c. Ground coffee offers, in fact, such a temptation to fradulent admixture, that no one should buy ground coffee, except from dealers of first respectability, but of these we may say with Virgilius,

" Apparent rari nantes in gurgite vasto."

And even then it is much better *for the consumer* to purchase a coffee mill, and to have his coffee ground at home; the expenditure of a few shillings will thus shelter him from all chance of fraud, and secure to him an infusion of coffee of an improved flavor, since ground coffee, even when genuine, gradually loses its aroma by keeping.

7. Of all the adulterations of ground coffee, that with chicory is the most prevalent. Whether the admixture of chicory with coffee in the proportion of one or two ounces of chicory to the pound of coffee, gives *body* and *depth* of color is a point which cannot be disputed; it *does* give *body* and *depth* of color, but this is a quality of a questionable nature, and one which, certainly, no exercised palate will relish. At any rate, when it is considered that the chicory itself may be purchased separately, and at a much lower price, of course, than coffee, we would advise the consumer to buy his coffee *unground*, and to add thereto whatever proportion of chicory may suit his taste.

8. With respect to the medicinal properties of chicory, which are said to be such as to *improve* those of the coffee, and to modify its stimulating action; if it does so, it cannot be otherwise than by dilution, and those who, on that account, consider the addition not only as unobjectionable but as proper, should on the same ground allow the grocer to mix hay, or straw, or bran, with his tea, with a sprinkling of extract of logwood, and the publican to add water to his beer and spirits, the whole out of pure regard to the health of the customer, and merely to correct or modify the stimulating action of these goods. Chicory has no other virtue than that of imparting a brown color to the water in which it is boiled or infused, of giving, at the same time to the liquid, a flat, sweetish, bitter taste, and of *being much less expensive than coffee;* water, in reference to beer and spirits, possesses the last quality in an eminent degree, and if used (would it were so) by the publican to the same extent as the chicory by the grocer, there would be no drunkards.

9. However this may be, the adulteration of coffee by chicory may be detected in the following manner:—

10. As the roots of chicory after having been kiln-dried, roasted and ground, resemble ground coffee so closely as to defy detection when mixed with it, it becomes altogether impossible to detect its presence by the eye alone. But, if a little of the suspected coffee be first moistened, and then rolled between the fingers, it will, if in any quantity, form a little pellet or ball, whilst pure coffee treated in the same manner cannot be agglomerated and remains in powder.

11. The presence of chicory may also be detected by shrowing a portion of the suspected coffee into a glass of water, without

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stirring; the coffee remains for a while floating on the surface, but the ground chicory absorbs the water immediately, and falls to the bottom of the vessel, imparting a yellowish or brownish yellow color to the liquor. If the coffee under examination, instead of being thrown into a tumbler, is put into an inverted bottle from which the bottom has been removed, or into a funnel, the chicory which falls down first may be at once separated, by adroitly removing the cork, and collecting the chicory in any convenient vessel placed underneath, after which it may be easily identified by its taste and pastiness.

12. When, instead of chicory, roasted corn, peas, or beans, are employed, the operator may detect the fraud, by first making an infusion of the suspected coffee, decolorizing it as much as possible by means of animal charcoal, and testing the *cold* liquor with an aqueous, or an alcoholic solution of iodine, which in that case will produce the characteristic blue color indicative of the presence of starch.

13. Not only is coffee adulterated in the manner described, but the adulterating substance itself is often sophisticated. Thus ground chicory is often mixed with *torrefied ground rice* and *corn*, *roasted biscuit* or *bread*, which are cheaper than chicory. The presence of these substances may be detected in chicory as in coffee, by means of a solution of iodine, and also because, when thrown into an inverted bottle or funnel, as above described, the chicory absorbing water more rapidly, falls at the bottom first, and may be separated as we said before.

14. Chicory powder has been adulterated also with *brick-dust*, *ochre*, and other earthy matters, the presence and amount of which, however, may be most readily determined by incinerating a given weight of the suspected article; 100 grains of pure chicory yield from 4 to 5 grains of fixed residue, the excess indicates the fraud.

15. On the Continent, the material chiefly used to adulterate both *chicory* and *coffee*, is coffee grounds; this may be detected by first drying the suspected chicory in a water bath, and throwing a pinch of it, when dry, in water, as above directed; the chicory absorbs the water and sinks to the bottom of the vessel, whilst the *coffee grounds* remain on the surface. When, however, coffee is adulterated with coffee grounds, I know of no other way of detecting it but by the strength of the infusion, which in that case, of course, is less in proportion to the extent of the fraud.

* * * * *

17. Coffee is also met with in commerce as a manufactured article, in the state of essence, or rather of extract of coffee. That preparation, provided it be genuine, is peculiarly adapted to the use of travellers, who are thus enabled to procure a good cup of very good coffee without trouble and apparatus. Of all the attempts which have been made to manufacture such an extract, and of most of which I have had samples, I have found on examination, that only one kind, that manufactured by Dunn, of Pentonville, would keep. All the other samples which have come under my notice were (some of them) very good indeed; but the extract very soon fermented, in a few days it became acescent, and shortly afterwards, altogether sour and undrinkable, notwithstanding its being kept in the dark, well corked in a cool place, and, in fact, despite every precaution of a practicable kind which I adopted to prevent the change alluded to, and which finally converted the article into a mucilagenous ropy, acid extract, of a very disagreeable odor and flavor.

TO CORRESONDENTS.

"T. D. T."—If you will favor us with your address, we will send the answers to your enquiries: they are too long for insertion in this Journal.

"CHEMICUS."—If the stills are of large size, it will be advisable to acquaint the excise officer of the district of their being erected. The sale of spirit requires a license. We will send any further information, if "Chemicus" will send his address.

"W."—The formula is correct.

"A. B."—Every chemist who sells chloroform, if he has had it long in stock should examine it before sending it out.

"A WORKING CHEMIST."—The fault is with the fused cyanide employed: makers of this article have lately been using much more carbonate of potassa in its preparation than is proper.

NOTICE.—*All Communications, Books for Review and Substance for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

SIXTH COMMUNICATION ON THE BATTERY.—NOTE ON THE CHEMICAL PHENOMENON, AND ON THE LIGHT OF THE BATTERY WITH TWO LIQUIDS.*

BY M. C. DESPRETZ.

Some months ago, I made a very great number of experiments on the chemical phenomenon and on the light of the battery with two liquids. Although this double work is not quite finished, I communicate its principal results to the Academy.

More than twenty persons, French and foreign, witnessed my experiments. These experiments were very laborious, on account of the number of elements, and also of the arrangement of the apparatus. By this anticipatory publication, I shall avoid all discussion as to priority, a discussion which it is always troublesome to sustain.

The following are the results at which I have arrived :—

1. The nature of the light of the battery appears to be independent of the number and arrangement of the elements; indeed, if the electric luminous bundle be received, by means of a suitable apparatus, into a lunette in such a manner as to bring a blue or yellow ray of light into coincidence with a wire from the lunette, we perceived no displacement in the ray, when we passed from 100 to 600 elements end to end, or with 600 arranged in six parallel series of 100. This is only a question of refrangibility. It is, I think, an interesting experiment.

2. I have not yet been able to see with a prism of rock salt, if the tone or the temperature of the heat which accompanies the electric light changes with the intensity or the energy of the battery. I have only proved at present that this temperature is always sufficient for fusing alumina or silica whether 20 or 600 elements be employed. But the globule obtained is so much the smaller, as the battery is formed of a smaller number of elements of the same surface. This experiment proves only one thing, and that is that the temperature of a small number of elements is very high; but it is by the measure of the refrangibility alone that we can ascertain whether the temperature remains independent, like light, of the number and arrangement of the elements, that is to say, of the intensity and energy of the electricity. This experiment shall be made.

3. I have endeavored to measure the intensity of the electric light by different means: by the appreciation of the distance at which we can no longer read clearly, and by several known photometric processes.

The number of elements in a battery, arranged end to end (for intensity), exerts but little influence on the intensity of the light. This intensity increases from 50 to 100, from 100 to 600, but inconsiderably.

If, on the contrary, the elements be connected for quantity, so as to double, triple, &c., the surface, the increase of luminous intensity is appreciable by any process whatever. This increase was evident to all who were present at my experiments.

My principal object, in these experiments, was to compare the variation of the luminous energy with the variation of the number of elements or of the surface; but, notwithstanding the repetition of the experiments I have not yet very concordant numbers furnished by the different processes. The distances at which we read most clearly

* *Comptes Rendus*, No. 12, Sept. 16, 1850.

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indicate only that the luminous energy increases almost proportionally to the surface of the elements. 200 elements, placed in two parallel series of 100 each, gave nearly twice as much light as 100 simple elements, and so on to 600 elements, arranged in six parallel series of 100 each.

The want of constancy of the electrical light is a great obstacle to the complete success of these experiments. The intensity of this light varies every instant. The apparatus devised for rendering this light constant for a certain time are costly, and they are of some service; but the already very great difficulty of constructing these apparatus so as to produce a nearly constant light with a given battery, becomes much greater when it is necessary, as in our case, to regulate in each experiment the apparatus for a different number of elements or for a different arrangement of the same number of these elements.

Be it as it may, the results at which we have arrived are already important, if we are not mistaken, in a practical point of view. We have already shown how the batteries should be arranged to have the most electric light. These incomplete experiments show well the direction of the phenomenon. To make it more comprehensible, I will detail some experiments which I made for measuring the energy of the battery by the oscillations of the magnetic needle. I found, by this means, that 25 or 600 elements connected by a conductor of feeble resistance have the same energy.

The battery connected for quantity presents an energy which increases perceptibly on the surface. If these experiments be compared with those which I have presented on the voltaïc arc, and whose accuracy I have since verified by repeating them, it is evident that the number of the elements, which exerts so great an influence on the length of the arc, has little on the energy of the light and none on the intensity, measured by the magnetic needle. It is evident that the extent of the elements marks its influence by the increase of intensity, measured, either by the magnetic needle, or by light, or by chemical action.

I have for a long time been occupied with the internal chemical phenomenon and the external chemical phenomenon of the battery with two liquids. I have found that:—

1st. The quantity of zinc dissolved is so much the greater as the resistance of the interpolar conductor is weaker. The alteration of the nitric acid, estimated by the permanganate of potassa, proceeds with the solution of zinc. However, I must say that the proportion of the quantities of zinc destroyed is never accurately represented by that of the quantities of hyponitric acid formed, because there is disengaged so much the more nitrous acid into the air, as the current is more energetic.

2. The quantity of zinc dissolved in each pair of two batteries of the same number of identical elements, united by the same conductor, of which a metallic cog-wheel forms part, which is put in motion or left to repose, represents the quantity of gas disengaged in the voltameter, and is exactly proportional to the intensity of the current, measured by the compass with tangents; if the energy of the current were made to vary by the employment of different conductors, without the assistance of a wheel, the same consequences would be arrived at.

3. If we measure the time necessary for a battery composed of 2, 4, 8, 16, 32, 64, 128 or 256 identical elements, connected end to end, to produce the same external chemical effect, for example, to decompose the same quantity of water, it is evident that this time rapidly decreases from 2 to 4, from 4 to 8, that it varies little from 8 to 16, and almost imperceptibly from 32 to 64, from 128 to 256.

These experiments show that we gain little or nothing for the time by doubling the number of the elements when the battery is already composed of 8 elements, and as the loss of zinc and acid is the same in each pair for the same external chemical action, there is an actual advantage in not exceeding that number of elements. I speak here of the carbon battery; it should be the same with any battery with two liquids. I have not yet verified this by experiment.

In these experiments, the electrodes were platinum plates fixed and even soldered to flat bars of copper. All that part of the bars which should dip in the acidulated water was covered with mastick; the uncovered portion of the platinum plates had a surface equal to that of the zinc element of the battery: the distance of these plates was about 10·75 millimetres.

The acidulated water was composed of 1 part of sulphuric acid to 39 parts of water.

There was at first decomposed sufficient water to form 3·5 of mixed gases; but as this decomposition required more than three hours for two elements, the large tube in which the mixed gases were received was replaced by a narrower tube, of the height of 1 metre, and of the capacity of a quart.

I do not yet publish the results with all the details, because they do not comprise the whole of the chemical work which I intend to examine. I wish, besides, to make the derived currents intervene in these ex-

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periments, as well as in the experiments on the luminous arc, in order to have accurately the relations between the intensities of the current in one series of experiments.

In so brief a note, a recapitulation of the investigations which have been made, in France and other countries, on these various subjects, considered in a different manner, is unnecessary. I shall endeavor, in the memoirs which I shall have the honor of presenting to the Academy, to render to every one his due.*

My experiments on the chemical phenomenon of Bunsen's battery are characterised by the *simultaneous* estimation of the internal chemical operation, of the external chemical operation, and of the intensity of the current by the magnetic needle.

CREATINE, A CONSTITUENT OF THE FLESH OF THE CETACEA.†

BY DAVID S. PRICE, PH.D.

A FINE specimen of the Rorqual Whale *(Balænoptera musculus)* having been brought into Margate in February last, I availed myself of the opportunity afforded of ascertaining whether creatine, which has been found to be a constituent of the muscles of various animals, birds, and fishes, was likewise contained in those of the cetacea. It has been shown by Liebig that the muscles of fat animals yield a much smaller quantity of this substance than those of lean ones; and as the whale may be ranked pre-eminently among the former, it was deemed necessary, in order to ensure a decided result, that a large quantity of the flesh should be employed. For this purpose about 40 lbs., the freest from fat that could be selected, were treated in the manner described by Liebig in his research into the constituents of the juices of the flesh; 10 lbs. were cut into small pieces and well kneaded with an equal weight of cold water. The flesh was then removed to another vessel holding the same amount of water, and after being again well pressed, was put in linen bags into a strong screw press, and as much of the liquor obtained as possible; the second water served as the first receptacle for another 10 lbs. of flesh, which were treated in like manner, etc. In this way the extract from the 40 lbs. was eventually obtained. The large quantity of fat which collected on the surface of the water had to be removed prior to the liquor being strained through flannel bags for the purpose of separating any muscular fibre and fatty matter that might be suspended in it. The filtered liquid, which was of a blood color and exhibited an acid reaction, was heated in large evaporating pans over a water bath, whereby the albumen was coagulated, taking with it nearly the whole of the coloring matter, the liquid, on being strained through linen bags, retaining only a very faint color.

The odor and flavor of this filtrate were not distinguishable from those of the extract of beef. In order to separate the last traces of albumen, the liquid extract was rapidly heated to ebullition over a strong fire in a tinned copper vessel. After being filtered the solution was mixed with concentrated baryta water until a precipitate ceased to be formed, a point which was reached long after the acid reaction had disappeared. The almost colorless filtrate, when evaporated in the water bath, acquired a dark brown color, and became gradually gelatinous, emitting an odor very similar to that of glue. The concentrated liquor was now placed in a cool situation in several shallow vessels, when, after the lapse of forty-eight hours, numerous minute glittering crystals were deposited, which, owing to their great specific gravity, could be easily separated by decantation of the supernatant liquid. When dried in this minute state, these crystals presented a beautiful appearance, refracting light with remarkable intensity. After three or four crystallisations they may be obtained quite pure. If their aqueous solution be allowed to crystallise slowly, crystals one quarter of an inch in length are formed, presenting a silky lustre, and frequently arranged in groups. These crystals are insoluble in alcohol, but very soluble in boiling water, when warmed on platinum foil, they lose their lustre, becoming opaque and white; when heated more strongly they carbonise, emitting the odor of burning nitrogenous substances; on the application of a still stronger heat, the

* I will then relate what has been done by MM. Gay-Lussac and Thenard with the battery with a single liquid and unamalgamated zinc; by Faraday, Daniel, and MM. Bouquillon and Silberman with the single liquid battery and amalgamated zinc; by M. Pouillet with Daniel's battery with unamalgamated zinc, immersed in a solution of common salt or sulphate of zinc; by Grove on the gas battery, &c., on chemical action, and by Bunsen, MM. Fizeau and Foucault, and M. Casselman, &c., on the luminous intensity of Bunsen's battery.

† *Quarterly Journal of the Chemical Society*, October 1850.

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carbon is entirely consumed, no ash remaining behind.

0·3097 grms. of this substance, when kept for some time in a water bath at a temperature of 212° F., lost 0·0378 grms., corresponding to 12·2 per cent. of water, the amount found by Liebig in creatine prepared from different sources.

I must not omit to state that I obtained this substance (a specimen of which I have the honor to lay before the society) in very small quantity. There can be no doubt as to the identity of this body with that described by Chevreul, Liebig, Schlossberger, and Gregory; and we may safely conclude that it is a constituent, in greater or less amount, of the fluids of the flesh of all the higher class of animals.

ON THE ACID OF THE EQUISETUM FLUVIATILE, AND ON SOME ACONITATES.*

BY M. BAUP.

Some doubts having existed concerning the identity of the natural aconitic and equisetic acids, and of the pyrogenous citridic and maleïc acids, M. Baup undertook to clear up the matter. To that end, he extracted the acid of the *Equisetum fluviatile*, and of the aconite (*Aconitam napellus*), and compared them with pyrogenous citric acid (which is called citridic acid) and with maleïc acid.

From the comparative examination which he made of their properties and of several of their combinations, he was enabled to conclude with certainty that aconitic, equisetic and citridic acids are one and the same acid, which should be called aconitic acid, from whatever source it is derived: maleïc acid, although isomeric with it, is not identical with it, and should retain its name.

In the study of several aconitates, M. Baup observed a fact which deserves the attention of chemists, as being the first example of the combination of 3 atoms of an organic acid with 1 atom of base. The trisaconitates of potassa and ammonia have only very few representatives in inorganic chemistry, for example the trisiodate of potassa of Serullas.

During his investigations on the *equisetum*, M. Baup discovered in it a peculiar crystallisable yellow matter, giving to aluminised cotton a yellow tint, which does not give it up to woad, and he has given it the name of *flavequisetine*.

* *Comptes Rendus*, No. 11, Sept. 9, 1850.

ON BORACIC ACID AND ITS QUANTITATIVE DETERMINATION.*

BY PROFESSOR H. ROSE.

The various difficulties met with in the estimation of boracic acid have not hitherto been completely overcome by any known method. If the boracic acid be dissolved in water, evaporation will not give its entire amount. Besides, if the acid thus obtained from the aqueous solution is fused in a platinum crucible, its weight will constantly decrease unless the air be most carefully excluded. If the temperature is raised to a strong red heat, this decrease becomes far more considerable. The loss will, however, only amount to a few milligrammes, unless it is heated in a moist atmosphere; but if the cooled boracic acid is moistened with a little water, and again heated to redness, the loss will amount to some centigrammes, or still more if a drop of alcohol be used instead of water. Placing a small quantity of ammonia on the surface of the boracic acid will be found the best method of avoiding the loss in weight which occurs in the melting.

Some have proposed preventing the volatilisation of the boracic acid, during the evaporation of its aqueous solution, by previously supersaturating it with ammonia. But as boracic acid has but a slight affinity for ammonia, the latter will be expelled with the aqueous vapor.

The volatilisation will not be prevented even by the addition of chloride of ammonium to the aqueous solution of boracic acid, if, after the addition of this salt, the whole be evaporated and the dry residue heated in a platinum crucible until the fumes of chloride of ammonium cease, there will be a residue which will not fuse at the temperature at which pure boracic acid readily melts. Treated with water, nitroguret of boron remains undissolved as a whitish grey powder; the quantity varies, indeed, sometimes not a trace will be produced.

It is not possible to determine boracic acid quantitatively in the aqueous solution in the same manner as arsenic and phosphoric acid, by adding a weighed quantity of newly calcined oxide of lead to the solution, evaporating the whole, and then igniting or heating the mass, as the addition of oxide of lead will not prevent the escape of boracic acid on evaporation. Nitrate of lead is equally useless for this purpose.

Even the addition of a weighed quantity of tribasic phosphate of soda ($3SoO, PO^5$),

* *Berlin Berichten*, 1850.

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will give no quantitative result, as this salt does not prevent the volatilisation of the boracic acid from the aqueous solution.

The only possible way of estimating quantitatively the boracic acid in an aqueous solution, is, in fact, by the addition of a weighed quantity of a fixed alkaline car-

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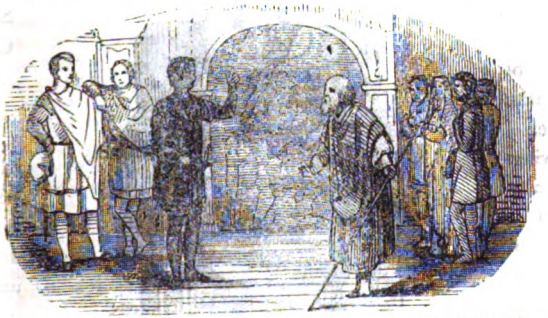

Ham. Good my lord, will you see the players well bestowed?
Pol. My lord, I will use them according to their deserts.
Ham. Much better, sir; use every man after his desert,
And who shall 'scape whipping? Use them after
Your own honour and dignity: the less they deserve,
The more merit is in your bounty.

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accurate way of separating boracic acid from bases is by means of hydrofluoric and sulphuric acids, the boracic acid being expelled as fluoride of boron, whilst the bases remain in the state of sulphates. Boracic acid may also be entirely converted into boracic ether by treating the borates with sulphuric acid and alcohol. This plan is, however, far less accurate than by using

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Strictly accurate results are not, however, attained by it, as phosphate of baryta is not

carbon is entirely consumed, no ash remaining behind.

0·3097 grms. of this substance, when kept for some time in a water bath at a temperature of 212° F., lost 0·0378 grms., corresponding to 12·2 per cent. of water, the amount found by Liebig in creatine prepared from different sources.

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ON BORACIC ACID AND ITS QUANTITATIVE DETERMINATION.*

BY PROFESSOR H. ROSE.

The various difficulties met with in the estimation of boracic acid have not hitherto been completely overcome by any known method. If the boracic acid be dissolved in

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* *Comptes Rendus*, No. 11, Sept. 9, 1850.

* *Berlin Berichten*, 1850.

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will give no quantitative result, as this salt does not prevent the volatilisation of the boracic acid from the aqueous solution.

The only possible way of estimating quantitatively the boracic acid in an aqueous solution, is, in fact, by the addition of a weighed quantity of a fixed alkaline carbonate; this method is, however, rather tedious, requiring much time and attention. Carbonate of soda is preferable to carbonate of potassa, being more easily weighed accurately. It is weighed off in the fused state, and put to as much solution as is supposed to contain the same or half the amount of boracic acid, it is dissolved in the solution, and evaporated at a gentle heat. Carbonic acid is not expelled from the carbonated alkalis, by free boracic acid at the ordinary temperatures; and at a high temperature, or on evaporation only in a very slight degree; it is not until the whole has been evaporated to dryness, and the dry mass strongly heated, that any evolution of carbonic acid occurs, when great care is necessary.

At a great heat, the mixture is liquid; at a lower temperature, only tenacious. If fused at as high a temperature as can be produced with a spirit lamp and a double draught, a certain weight is obtained on cooling, which will not vary even after long standing. But should the crucible be exposed to a moderate heat, after having been in a strong red heat, the weight strangely enough increases, and it is impossible to obtain, by this means, a certain weight. Whether the mass has been fused for a shorter or longer time, or whether the temperature employed has been higher or lower, the result will be the same. The carbonic acid in the fused mass is now estimated. If the amount of soda in the carbonate of soda used, and that of the carbonic acid which has escaped during the experiment, be subtracted from the weight of the fused mass, the quantity of boracic acid will be most accurately obtained. Although the same phenomena occur with carbonate of potassa, the results are somewhat less accurate, as this salt cannot be so accurately weighed off in the anhydrous state as carbonate of soda.

It is, however, only rarely possible to employ this method of estimating the amount of boracic acid in aqueous solution, and only when no other substance, excepting perhaps ammonia, is contained in the solution, and that is expelled even without the action of carbonate of soda.

It is well known that the best and most accurate way of separating boracic acid from bases is by means of hydrofluoric and sulphuric acids, the boracic acid being expelled as fluoride of boron, whilst the bases remain in the state of sulphates. Boracic acid may also be entirely converted into boracic ether by treating the borates with sulphuric acid and alcohol. This plan is, however, far less accurate than by using hydrofluoric acid, and should be tried when it is impossible to obtain concentrated hydrofluoric acid. When the method is employed, long ago proposed by L. Gmelin, of using hydrochloric instead of sulphuric acid, the boracic ether is produced with much less ease, the volatilisation of the boracic acid is slower and not so complete.

No direct method of estimating boracic acid is as yet known, because this acid does not form with any base a compound which is entirely insoluble in water. The fluoboride of potassium is the only compound by means of which it could be completely separated; this salt is very sparingly soluble, resembles the silicofluoride of potassium, and like that is insoluble in alcohol; Berzelius says that it is somewhat soluble in it, which, however, is a mistake. It is more soluble in a solution of chloride of ammonium than in pure water. A great many experiments have, however, proved that it is impossible to estimate boracic acid quantitatively as fluoboride of potassium; it will not succeed even when the solution contains free boracic acid. If pure hydrofluoric acid be added to the solution, and then carbonate of lime to separate the excess of acid, and lastly acetate of potassa and alcohol to the filtered liquid, a fluoboride of potassium is obtained, which always contains fluoboride of calcium. But the results are far less accurate when the boracic acid is combined with a base, such as soda, and the above method is employed. Von Kobel has proposed to effect the separation of boracic from phosphoric acid by adding to the solution one of perchloride of iron, and then precipitating by an excess of lime; the addition of the solution of perchloride of iron is, however, unnecessary. Hydrochloric acid being added to the solution of a borate, and the mixture treated without heat with an excess of carbonate of baryta, no boracic acid is contained in the insoluble residue, which contains only carbonate of baryta. Carbonate of baryta, on the contrary, entirely precipitates phosphoric acid, whether free or combined, without heat, when some nitric or hydrochloric acid is added to the solution. Carbonate of baryta will, consequently, separate boracic acid from phosphoric acid. Strictly accurate results are not, however, attained by it, as phosphate of baryta is not

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perfectly insoluble in a solution of borax. When phosphate of baryta is digested in a concentrated solution of borax without heat, the filtered solution after some time contains traces both of baryta and phosphoric acid, the latter being easily detected by molybdate of ammonia. Consequently, when a mixture of phosphate and borate, after the addition of hydrochloric acid, is treated with an excess of carbonate of baryta, without heat, and frequently stirred and filtered, the wash water leaves, after twenty-four hours, even after long edulcoration, a residue on evaporation, and molybdate of ammonia proves traces of phosphoric acid. But should the insoluble residue, after some washing, be dissolved by hydrochloric acid, the baryta removed by dilute sulphuric acid, the phosphoric acid precipitated as ammonio-phosphate of magnesia, and the amount of phosphoric acid calculated from the calcined residue, a loss of phosphoric acid will be perceived, but it is inconsiderable; so that a result approximating closely to the truth will be attained by this process.

When ammonio-phosphate of magnesia is digested, without heat, in a concentrated solution of borax, no phosphoric acid will be detected in the filtered solution. If a solution contains boracic and phosphoric acids, the latter may, therefore, be separated by precipitating it as ammonio-phosphate of magnesia, unless the solution likewise contains other substances, which will be precipitated on the addition of ammonia and a solution of magnesia. The precipitate will contain a slight trace of boracic acid. By this plan, a small excess of phosphoric acid is therefore obtained, similar to the loss occuring with the carbonate of baryta process.

The difficulties which attend the estimation of fluorine with boracic acid have not as yet been surmounted. When the solution is acidified with nitric acid, an excess of carbonate of lime added, and the mixture heated and filtered, the whole amount of the fluoride of calcium corresponding to the fluorine in the solution is not obtained. Fluoborides have been formed, which are merely partially, and sometimes not at all, decomposed by the treatment with carbonate of lime.

Fusion with an excess of carbonated alkali will completely separate boracic acid from bases in insoluble compounds; at least, by fusing borate of baryta and borate of magnesia with carbonate of soda, and treating the fused mass with water, the whole of the bases were procured quite free from all trace of boracic acid.

ON THE NITROGENOUS PRINCIPLES OF VEGETABLES, AS THE SOURCES OF ARTIFICIAL ALKALOIDS.

BY DR. JOHN STENHOUSE, F.R.S.

It is well known that several organic alkaloids, such as aniline, Picoline, Petinine &c., are obtained in the dry distillation of coal. Now, as coal is of vegetable origin, and these organic alkaloids all contain nitrogen, it is evident that they must be ultimately derived from the azotized principles contained in the plants from which the coal has been formed. Hence it appears probable that those proximate vegetable principles which are rich in nitrogen, such as vegetable albumen, fibrine, legumine, &c., will, when subjected to destructive distillation, yield these same alkaloids, or bodies closely resembling them, in larger quantities than the coal itself,—inasmuch as the powerful agencies to which that substance has been subjected during the course of its formation, must have destroyed a large amount of these azotized principles; and moreover, the great bulk of it is made up of non-azotized matter, the residue of woody fibre, &c., which can contribute nothing to the formation of the alkaloids. By considerations such as these, the author was induced to undertake the researches of which the following is an abstract.

Since vegetable albumen, fibrine, and caseine, are very difficult to obtain in a state of purity, the experiments were made with those parts of plants, chiefly seeds, which contain those principles in the greatest abundance. The first experiment was made with the seeds of the common horse-bean (*Phascolus communis,*) which contain about 22 per cent. of azotized matter. The beans were subjected to dry distillation in cast iron retorts, and the distilled products condensed by a Liebig's condenser. A strongly alkaline liquid was obtained, containing, besides other products, acetone, wood-spirit, acetic acid, empyreumatic oils, tar, a very large quantity of ammonia, and several organic bases. The crude product was treated with a considerable excess of hydrochloric acid; the clear liquid decanted after the tar had settled to the bottom; the tarry residue treated several times with water containing hydrochloric acid; the several acid liquids mixed, and the whole boiled for a couple of hours. By this treatment, the acetone, wood-spirit, and a large proportion of the empyreumatic oils, were either driven off or separated by conversion into resinous matter. The acid liquid was then filtered through charcoal to separate the resins, and afterwards mixed with lime

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or soda and distilled. The distillate contained a large quantity of ammonia, together with oily basis, the amount of the latter being greatest in the first portions which passed over. The oily liquid was separated from the ammoniacal solution by means of a pipette; neutralized with hydrochloric acid, whereby the neutral oils mixed with the organic bases were left undissolved, and could be separated by filtration, and the solution supersaturated with carbonate of soda, and distilled in a large retort. The oily bases again passed over, together with a quantity of ammoniacal liquid, from which they were separated by the pipette. An additional quantity was obtained from the weak alkaline liquid which passed over at the latter part of the first distillation, by neutralizing that liquid with hydrochloric acid, concentrating by evaporation, supersaturating with carbonate of soda, and again distilling. The oily bases obtained by these operations were again rectified with water to purify them from the resinous matter which still remained; then repeatedly agitated with strong potash-solution, which dissolved out the remaining portions of ammonia, and formed a solution which could be separated from the oily liquid by means of a funnel; and lastly, dehydrated by repeated agitation during several days with fused hydrate of potassa, and subsequent distillation. The first two-thirds of the oily distillate were colorless; the remainder had a yellowish color, but was likwise rendered colorless by repeated rectification.

The boiling-point varied considerably during the distillations, showing that the oily liquid obtained was a mixture of different bases. An attempt was therefore made to separate these bases by fractional distillation. The liquid began to boil at 108° C., at which point a small portion of a transparent, colorless oil passed over. The thermometer then rose quickly to 120°, and from thence to 130°, at each of which points small portions were collected. Between 150° and 155°, the boiling point remained stationary for a considerable time, and a considerable quantity of oil then distilled over; about the same quantity was collected between 160° and 165°. The boiling-points of the last portions varied between 165° and 220°. The products of these different distillations were again repeatedly rectified, and by this means bases were obtained corresponding more closely with those points at which the thermometer remained stationary during the first distillation.

These bases, though differing considerably in their boiling-points, nevertheless resemble each other very closely in their other characters. They are colorless, transparent oils, with strong refracting power, lighter than water, and having the peculiar pungent, slightly aromatic odor which is characteristic of this class of bodies. The odor remains on the hands and clothes for a long time, and is strongest and most pungent in those bases which are most volatile. They have a hot taste, not disagreeable in a state of dilution, and resembling that of oil of peppermint. The bases which distil over at low temperatures are tolerably soluble in water,—at any rate, more soluble than those whose boiling-points are high. They all dissolve in every proportion in alcohol and ether. They exhibit strong alkaline reactions with turmeric and reddened litmus-paper, emit copious fumes with hydrochloric acid, and neutralize acids perfectly, generally forming crystallizable salts. With the chlorides of gold, platinum, and mercury, they form double salts, soluble in water to nearly the same extent as the corresponding ammoniacal salts. They precipitate ferric and cupric salts, the precipitate in the latter case being easily soluble in excess, and yielding a deep blue solution. They do not alter by partial exposure to the air, but if exposed to a strong light, they turn yellow, especially those which boil at the higher temperatures. Nitric acid converts them into yellow resins, but without forming carbazotic acid. With hypochlorite of lime they form brownish resins, but give no trace of analine. When boiled for a few minutes in a retort, they gradually become colored, though the liquid which distilled over was colorless at first. At the close of the distillation, a small quantity of resinous matter remained in the retort.

The quantity of these bases obtained was not sufficient to yield any very definite analytical results. It is not that the proportion of bases yielded by beans and other seeds is less than that obtained from animal substances; on the contrary, it is equal to that obtained from bones, and much greater than that yielded by coal: but we have not the advantage—as in the case of bones and coal—of being able to procure the crude oils in large quantity as the waste-products of manufacturing operations; and consequently the chemist is obliged to distil the seeds on purpose, an operation requiring very large apparatus and not conveniently conducted in the laboratory.

The base which boiled between 150° and 155°, was found by analysis to contain about 74·7 per cent. of carbon and 7·98 •

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hydrogen, numbers which nearly correspond with the formula,

$$C^{10} H^{6} N.$$

This formula was likewise confirmed by the analysis of the platinum-salt. The combination of this base in the anhydrous state with hydrochloric acid is attended with great evolution of heat. The hydrochlorate is very soluble in water, and crystallizes in slender prisms. Similar compounds are formed with sulphuric and nitric acid. The platinum salt crystallizes in four-sided prisms arranged in stars of a deep yellow color. The gold-salt is very soluble in hot water, and crystallizes in pale yellow needles on cooling. The composition of this base approaches very closely to that of nicotine, $C^{10} H^{7} N$; but its properties agree more nearly with picoline, the base discovered by Dr. Anderson in coal-tar. It has, however, a higher boiling-point, and is less soluble in water than the latter. It is lighter than water, has a peculiar and slightly aromatic odour, and a hot taste resembling peppermint; dissolves in every proportion in alcohol and ether; and remains colorless though kept in an imperfectly stoppered bottle, provided it be not exposed to a strong light. It takes fire readily, and burns with a bright smoky flame.

Three of the bases with which the preceding compound was accompanied were likewise analysed and gave the proportions of carbon and hydrogen stated in the following table: (*a*) is the base, or rather mixture of bases, which boiled between 160° and 165°; (*b*) between 165° and 170°; (*c*) between 200° and 210°.

	a.	*b.*	*c.*
Carbon....	74·08	75·42	75·63
Hydrogen..	8·06	8·52	8·73

It is rather remarkable that the amount of carbon and hydrogen in these bases, or rather mixtures of bases does not differ more, considering the great difference in their boiling points. They all form double salts with gold and platinum; those which contain the less volatile bases, however, crystallize less readily, and are more contaminated with resinous matter. Their solubility in water likewise diminishes as the boiling-point rises. They all appear to possess equally strong basic properties. More complete investigation was precluded by the great difficulty of procuring these bases in sufficiently large quantity.

The next substance subjected to destructive distillation was oil-cake, or rather the dried seeds of *Linum usitatissimus*, from which the fat oil had been expressed. This substance was selected as the type of that numerous class of plants in which the starch of the *Graminaceæ* is replaced by oil. Of these, the poppy, rape, and mustard are the best known; they are all very rich in albumen. About 2 cwt. of oil-cake was broken into moderate-sized pieces and distilled in the same apparatus as had been used for the beans. The liquid product was smaller in quantity than that obtained from the beans: it had an extremely unpleasant odor, and contained acetone, acetic acid, a large proportion of tar and empyreumatic oils, and a considerable quantity of ammonia. The quantity of organic bases was, however, not more than one-third of that obtained from the beans. The deficiency may, in all probability be attributed to the higher temperature required for the distillation of the oil-cake, inasmuch as the volatile alkaloids are decomposed at high temperatures, with evolution of ammonia.

The bases obtained from the oil-cake were separated and purified by the process already described in the case of the beans. They consisted of a mixture of basic oils different from those yielded by coal or by bones, inasmuch as they contained neither aniline nor quinoline. Their odor was different from that of the bases obtained from beans, but they resembled the latter closely in their basic properties and in the characters of their salts. On the whole it seems probable that some of the bases of the two groups may be identical.

The grain of wheat (*Triticum hybernum,*) which was chosen as the type of the Graminaceæ, yielded by dry distillation products very different from those previously described—the distillate being strongly acid, from the presence of a large quantity of acetic acid derived from the starch in the grain. Acetone and wood-spirit were likewise present in considerable quantity. The distillate likewise contained a large quantity of ammonia, but the proportion of organic bases was very small, somewhat less than from oil-cake. These organic bases were very similar to those obtained from the preceding sources, but appeared to be more volatile: they contained neither aniline nor quinoline.

Peat, from the moors near Glasgow, when subjected to the destructive distillation, yielded a distillate which was nearly neutral, and contained a large quantity of acetic acid, besides acetone and wood-spirit. The acid distillate was mixed with hydrochloric acid and boiled to drive off the acetone and wood-spirit—whereupon, as the liquid cooled, the tarry matter separated as a semi-solid crust on the surface, and could

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be easily removed. The clear liquid was then supersaturated with carbonate of soda and distilled. An ammoniacal liquid passed over, mixed with a considerable quantity of oily bases which were separated as in former cases. The quantity of these bases was much greater in proportion to the ammonia than in the distillate from the linseed-cake, probably because they distilled over at a lower temperature. They strongly resembled the preceding groups and contained neither aniline nor quinoline.

Wood.—The rough distillate of beech, oak, ash, and other hard woods obtained in the manufacture of pyroligneous acid (for which purpose the stems and thicker branches are exclusively employed) was found to contain scarcely a trace either of ammonia or of organic alkaloids. Hence it would appear that the stems of trees are almost destitute of azotized matter, presenting in that respect a striking contrast to peat. This difference may, perhaps, throw some light on the origin of coal. For coal, when subjected to destructive distillation, yields a large quantity of azotized products, and must therefore have been formed from vegetable matter rich in nitrogen. Hence the theory which regards it as produced by the submersion of peat-bogs appears to be more probable than that which attributes it to the submersion of trees. It is true that the bases derived from peat are not the same as those from coal; but on the other hand, it must be remembered that plants of different families, when submitted to dry distillation, yield different groups of volatile bases: thus, plants of the indigo tribe yield ammonia and aniline; tobacco-leaves yield ammonia and nicotine, &c., &c. Hence the difference in the distillation-products of peat and coal may perhaps be ascribed to the difference between the plants from which the coal-strata have been formed and those of which the peat-mosses of the present day are composed.

FORMATION OF ORGANIC BASES FROM AZOTIZED VEGETABLE AND ANIMAL SUBSTANCES OTHERWISE THAN BY DESTRUCTIVE DISTILLATION.

1. *By treating them with alkaline leys.*—A quantity of beans was introduced into a large distillatory apparatus and boiled with caustic soda. The beans were soon converted into a slimy dark-colored pulp, which frothed up considerably and rendered the distillation very troublesome. By carefully rectifying the crude distillate, a clear, strongly alkaline liquid was obtained, which contained a large quantity of ammonia, a small quantity of an aromatic oil having an agreeable odor, and a notable quantity of organic bases. These bases were separated in the same manner as in former instances. They were similar to those obtained by destructive distillation, but the author could not positively decide as to whether they were identical. Oil-cake yielded similar results, and hence we may conclude that the same would be the case with the azotized portions of other plants, when similarly treated.

The liver of an ox boiled with caustic soda yielded a strongly alkaline liquid, from which a small quantity of oil bases was obtained, but not sufficient to determine their nature.

2. *By the aid of Sulphuric acid.*—A small quantity of beans was digested with dilute sulphuric acid, care being taken not to let the action proceed so far as to cause the evolution of sulphurous acid. The acid liquid, supersaturated with carbonate of soda and distilled, yielded an ammoniacal distillate containing organic bases similar to those already described. Hence it is probable that animal substances, similarly treated, would likewise yield organic bases.

3. *By Putrefaction.*—A quantity of horse-flesh, previously exhausted of soluble matters by long-continued boiling, was moistened with water and left to itself in a warm place for a month. When it had reached a somewhat advanced state of putrefaction, it was treated with water containing hydrochloric acid as long as anything was dissolved out, and the acid liquid concentrated, filtered, supersaturated with carbon of soda, and distilled. An alkaline liquid passed over, from which, by repeated rectification with caustic soda, a light oily fluid was obtained, consisting of several organic bases mixed together. It had an aromatic and not unpleasant odor, was very soluble in water, strongly alkaline, and formed crystalline salts with acids. Contrary to expectation, however, it was found to be quite free from aniline. The quantity of organic bases obtained from this source was not so great as might have been expected; being much less than that produced by destructive distillation. Perhaps, however, if the putrefaction were suffered to go on for a longer time—till, in fact, the flesh should be completely decomposed—the quantity of bases thereby produced might be greater than that resulting from destructive distillation. Considering, indeed, the very gradual nature of the putrefactive process, it may possibly be found the most advantageous that can be adopted for the preparation of these alkaloids on the large scale.

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4. *Organic bases from Guano.*—A quantity of Peruvian guano, very dry, of pale yellow color, and emitting a comparatively feeble odor, was distilled with water and an excess of quick lime. The distillate, which was strongly ammoniacal, was saturated with hydrochloric acid, evaporated to one-third of its bulk, then supersaturated with carbonate of soda, and re-distilled.

The liquid which passed over contained a small but appreciable quantity of oily bases, which appeared to be more easily soluble in water than those obtained from the preceding sources.

Bases from Lycopodium.—A quantity of lycopodium (the reproductive matter of lycopodiaceæ) boiled with strong caustic soda, evaporated to dryness and distilled, yielded a considerable quantity of ammonia, and a basic oil, which was but slightly soluble in water, and had a peculiar, very penetrating odor, like that of the borage plant. It neutralised acids completely, but in other respects did not resemble the bases previously mentioned. The same oil was obtained by destructive distillation of the plant; towards the end of the operation, however, another oily liquid was obtained having an odor more like that of the bodies previously described. This result with lycopodium affords another instance of the fact that plants of different natural families, yield different groups of volatile organic bases.

Bases from Pteris aquilina.—The stems and leaves of the common fern (*P. aquilina*) being subjected to distillation, yielded a very alkaline liquid, containing ammonia and a tolerably large quantity of organic bases, the odor of which was very much like that of the bases obtained from beans and from linseed.

From the facts above detailed, it seems to follow that "*Whenever ammonia is produced in large quantity from complex animal or vegetable substances, it is always accompanied by the formation of volatile organic bases.*" If, therefore, researches similar to the above are actively prosecuted, and especially if the seeds and leaves of the various genera of plants are subjected to similar processes, it seems not unreasonable to expect that the number of volatile organic alkaloids will ere long be considerably increased.

Another inference which seems to follow from these experiments is, that the nitrogenous principles of these plants, viz. vegetable albumen, caseine, fibrine, &c., though very analogous to the corresponding principles of the animal kingdom, are not identical with them; otherwise the products of decomposition would be the same.

In conducting the destructive distillation of animal and vegetable substances, it is important to operate at as low a temperature as possible; for if the heat be raised too high, the organic bases are almost totally destroyed, ammonia being then the only alkaline product. It is highly probable that, in many cases, the ammonia obtained in the distillation of animal and vegetable substances is really derived from the destruction of organic bases; for these organic bases are more complex in their structure than ammonia; and the most stable of them, when passed once or twice through a tube filled with red-hot charcoal, are almost entirely converted into that alkali; and even when organic bases are strongly heated in contact with potash or soda, or when their aqueous solutions are simply boiled for any length of time, they always undergo partial decomposition, ammonia being an invariable product.

AN ACCOUNT OF SOME EXPERIMENTS ON THE CAUSE OF FERMENTATION.*

BY MR. ERNI.

THE experiments and observations on fermentation here communicated by Mr. Erni were made in the course of the year 1847, in the Chemical Laboratory of Zurich. Their publication has been deferred because Mr. E. left Switzerland before they were extended and perfected so much as he had desired. It is well known among chemists that, notwithstanding the voluminous writings on fermentation, we yet know very little of its original cause, and no one of the theories advanced is competent to the full explanation of the facts known at present. It is doubtless true that in this process by the action of the so-called ferment, organic bodies of complex composition, such as sugar, &c., are decomposed into simpler substances.

The cause of these phenomena is considered by Liebig to be the power of the ferment as a body in a state of decomposition, i. e., in chemical action, to induce a similar transformation of compounds that come in contact with it. Other chemists assume that fermentation is caused by the development of fungi, and that different kinds of fermentation are due to different fungi.

The results which Mr. Erni has obtained, a part of which have been fully corroborated by more recent examinations, have enabled

* Read before the American Association for the Advancement of Science; from *The New York Tribune.*

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him to throw considerable light on some disputed points. A great variety of experiments were published by Brendecke, according to which, porous substances, as straw, feathers, alum, pulverised charcoal, potatoe starch, flour of sulphur, scraps of paper, and even small fragments of some metals, as tin, for instance, induce fermentation in a solution of grape sugar, to which some tartrate of ammonia had been added. After this it seemed probable that yeast consisting undoubtedly of vegetable cells, might like the substances mentioned produce fermentation in solutions of cane or grape sugar, not by means of the vital force, but simply by its looseness and porosity. In repeating some of Brendecke's experiments, Mr. Erni had used grape sugar, prepared from honey by means of alcohol and purified by boiling with charcoal, and cane sugar prepared from white refined sugar recrystallised from solution in hot water. In the experiments one part of sugar and eight of water were employed.

First Experiment.—In the first experiment, common straw was treated with potassa lye, to dissolve any gluten it might contain. After twenty-four hours the straw was washed with water, the last traces of potassa removed by hydrochloric acid, and finally the straw perfectly cleaned with water. The solution of cane and grape sugar mixed with such straw underwent no change during four weeks.

Second Experiment.—Addition of tartrate of ammonia to such solutions as above, produced no perceptible effect.

Third Experiment.—Clean straw as mentioned, together with cream of tartar, induced no fermentation in either cane or grape sugar.

Fourth Experiment.—Pulverised quartz added to solutions of cane and grape sugar, caused no fermentation. In the course of some weeks, mucor or mould was formed, which fructified and yielded spores. Such was the case not only in this, but also in some of the previous experiments.

Fifth Experiment.—A solution of cane sugar was mixed with uncleaned natural straw, in order to see if it excited fermentation, and if so, to ascertain if it may not be owing to the developement of fungi. After twelve days, fermentation commenced, and at the same time microscopical examination of the liquor showed the presence of vegetable cells identical with the upper yeast.

Sixth Experiment.—The same experiment performed with grape-sugar yielded the same results, but fermentation commenced some days earlier.

Experiment Seven to Eleven.—These experiments were made upon yeast. Rosseau made known the supposed fact that fermentation may be induced by yeast, even in the presence of vegetable or mineral poisons, if rendered acid when mixed with the sugar solution. The trials of Mr. Erni did not confirm these statements. He found:

1. That upper yeast in cane-sugar solution, acidified with tartaric acid, and poisoned with arsenious acid, produced no fermentation. The same mixture without the addition of oxide of arsenic, fermented after two days. The liquor was strongly acid by taste, became sweet again, and fermentation commenced.

2. The same trial was made in a liquor acidulated with acetic acid, and no fermentation took place. The same mixture without the oxide of arsenic produced fermentation.

3. The above two experiments were repeated using oil of turpentine as a poison, instead of arsenious acid, and the same negative results obtained.

4. Yeast added to cane or sugar solution, acidified with tartaric or acetic acid and poisoned with a few drops of creosote, excited no fermentation whatever.

5. Mixtures of cane and grape sugar with yeast, acidified with cream of tartar, and poisoned with considerable quantities of arsenious acid, yielded fermentation. Perhaps in this case the arsenious acid formed a chemical compound with the cream of tartar, as such a salt was proved to exist by Mitscherlitz.

6. The same experiment repeated, with the difference that in the place of arsenious acid, creosote and oil of turpentine were employed, showed no fermentation.

When the poisoned liquors were examined under the microscope, it could be easily seen when the poison had taken effect, the nitrogenous layer on the cell membrane seemed to have undergone a change similar to that produced by boiling.

Mr. Erni's investigations thus far led him to the conclusion *that alcoholic fermentation is caused by the developement of fungi.* He could never trace fermentation, without observing at the very first evolution of carbonic acid, the formation of yeast-cells, although it is very difficult to decide certainly which precedes the other. He was rather in favor of the yeast-cells being the original movers—the results of Mitscherlich's experiments. Helmholz has also observed that the fermentation of grape-juice is not communicated to another portion of grape-juice, which is contained in a vessel closed by a bladder, and introduced into the fermenting liquid. These facts, together

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with the experiments as to the action of poison on yeast, seem to admit of no other explanation even by the ingenious theory of Liebig.

Mr. Erni adduced a number of his experiments on other kinds of fermentation, showing that different kinds of fermentation are due to different kinds of fungi.

DESCRIPTION OF AN AMMONIA-METER.

BY J. J. GRIFFIN, F.C.S.

In a communication to the Chemical Society about four years ago, Mr. Griffin gave an account of some experiments, tending to prove that mixtures of liquid ammonia with water possess a specific gravity, which is the mean of the specific gravities of their components; that in all solutions of ammonia, a quantity of anhydrous ammonia weighing 212½ grains, which he calls a *test-atom*, displaces 300 grains of water, and reduces the specific gravity of the solution to the extent of ·00125; and finally, that the strongest solution of ammonia which it is possible to prepare at the temperature of 62° Fah., contains in an imperial gallon of solution, 100 test-atoms of ammonia.

The form of the instrument devised by Mr. Griffin is that of an ordinary glass hydrometer, with a paper scale, showing 100 degrees. Every degree indicates one test-atom, or 212½ grains of anhydrous solution in the gallon of solution. The zero of the scale signifies pure water at the temperature of 62° Fah. The first degree signifies one test-atom of ammonia, and the hundredth degree, 100 test-atoms. The specific gravity of the liquor, which corresponds with 100° of strength is ·875, water being taken at 1·000.

In order to render the indications afforded by this instrument useful to manufacturers, Mr. Griffin has prepared a table, which shows the constitution of the 100 solutions of ammonia corresponding with the 100° of the instrument. This table gives the specific gravity of the solutions; the weight of an imperial gallon in avoirdupois, pounds and ounces; the per centage of ammonia by weight; the degree of the solution as indicated by the instrument, corresponding with the number of test-atoms of ammonia present in a gallon of the liquor; the number of grains of ammonia contained in a gallon; and, lastly, the atomic volume of the solution, or that measure of it which contains one test-atom of ammonia.

The ammonia-meter and the table together, will enable a manufacturer to determine, not only the actual strength of any given liquor, but the precise amount of dilution necessary to convert it into a liquor of any other desired strength; and the direct quotation of the number of grains of ammonia contained in a gallon of solution, enables one to judge at a glance at the money value of any given quantity of ammonia.

Although there can be no doubt that the best hydrometer that can be made stands in point of accuracy far behind the chemical process of centigrade testing, yet the utility of the ammonia-meter to the manufacturer and to the consumer of ammonia, will be very great, and much credit is due to Mr. Griffin for the construction of so good an instrument, and for the elaborate table which accompanies it.

ON A COMPOUND OF RESIN AND LARD.*

BY PROFESSOR OLMSTEAD.

Professor Olmstead read a paper on some curious properties of a compound of resin and lard. He said: An accident first led me to observe something remarkable in this compound, and I have since made a few experiments, with a view of further investigating the relation between these two substances. Wishing to fit some brass of an old air-pump, so as to make a close joint with the receiver, I had been accustomed to apply to the plate a disc of leather, saturated with lard. With the hope of rendering it more completely impenetrable to air, I added to the lard a small quantity of resin, and melted them together. I expected the resin would give greater hardness to the lard, and make it fill the pores of the leather more effectually, but was surprised to find that the change produced by the resin was to impart to the lard a tendency to remain in the fluid state, so that, in a winter's day, the compound, when cold, remained in the state of a semi-fluid, at the temperature of a room moderately heated. I found, also, that this preparation, when applied to the leather of the air-pump, rendered it peculiarly soft, and at the same time, very impermeable to air, so as to form a good joint with the receiver.

But what arrested my attention more particularly was, that having inadvertently left the leather on the plate of the pump

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for nearly a year, during which time the use of the apparatus was discontinued, I supposed, when I took it out again, that I should find the brass plate much corroded, as I had sometimes seen it before, when exposed for a much less time to the action of the oiled disc of leather; but, on the contrary, the brass was entirely free from the corrosion, and I have uniformly found the same to be the case since, however long the leather may have remained in contact with the plate. This observation suggested another and more important use of the same preparation for lubricating the piston, which, being likewise of brass, and moving in brass barrels, had before occasioned me much inconvenience, by their liability to corrode by the action of the oil used in lubricating on the brass. Moreover, the tendency of the preparation to assume the fluid state by the friction of the piston, made a very convenient and effectual application for this purpose.

I have recently made a few experiments, with a view of ascertaining the melting point of this compound, and the proportions of the ingredients which give the lowest melting point. The best proportions are by weight—lard, three parts; resin, one part. If the resin be added in fine powder, and the mixture well stirred (without the application of heat), it softens, and so nearly approaches a fluid, as to run freely when taken upon a stirring-rod, at a temperature of 72 degrees. On melting the mixture, and in setting aside to cool, the following changes take place:—At 90 degrees, it remains transparent and limpid; at 87 degrees, a pellicle begins to form on the surface, and soon after it begins to grow slightly viscid, and as the temperature descends, it passes through different degrees of viscidity, like oils of different qualities, until at 76 degrees, it becomes a dense semi-fluid. It is an unexpected result, that the addition of one part in four of resin, whose melting point is near 300 degrees, to lard, whose melting point is at 97 degrees, should render it more fluid, reducing its melting point to 90 degrees, imparting to it the properties of a semi-fluid, at a temperature as low as 76 degrees, and even rendering the preparation of a softer consistency than lard itself, at a temperature as low as 60 degrees.

This compound of lard and resin has, therefore, two somewhat remarkable properties:—

1. It prevents in the lard, and probably in all the animal oils and fats, that tendency to generate an acid, and thus to undergo spontaneous decomposition. A much smaller portion of resin than one-fourth, gives to lard this property, destroying as it does the tendency of these substances to oxidation.

Several important practical applications result from this property. Its use for lubricating surfaces of brass or copper has already been adverted to. It is equally applicable to surfaces of sheet iron. I have found a very thin coating, applied with a brush, sufficient to preserve Russia iron stoves and grates from rusting during summer, even in damp situations. I usually add to it a portion of black lead, and this preparation, when applied with a brush in the thinnest possible film, will be found a complete protection to sheet iron stoves and pipes. The same property renders the compound of lard and resin a valuable ingredient in the composition of shaving soap. The quality of shaving soap is greatly improved by a larger proportion than is usually employed, so as to completely saturate the alkali, but such soap easily becomes rancid when wet with water, and suffered to remain damp, as it commonly is when in use. If a certain proportion of compound is added to Windsor soap (say one-half its weight), the tendency to grow rancid is prevented. A very soft and agreeable shaving compound, or "cream," may be made by steaming in a close cup a cake of any common shaving soap, so as to reduce it to a soft consistence, and then mixing intimately with it half its weight of our resinous preparation, adding a few drops of some odoriferous substance. The same compound forms an excellent waterproof paste for leather. Boots, when treated with it, will soon afterwards take the usual polish when blacked, and the soles may be saturated with it without danger of soiling the floor, as it does not rub off, while the leather is rendered in a high degree impervious to water.

The perfect solution into which resin passes when heated with oil, suggested the possibility of improving, in this way, the quality of oils used for illumination, and by its reducing the melting point of lard, to render that more suitable for burning in solar lamps. I therefore added powdered resin to lard oil, in the proportion of eight ounces of resin to one gallon of oil, and applied a moderate heat, sufficient to produce perfect solution. I then filled two solar lamps, equal in all respects—one with lard oil, the other the same holding the resin solution, and regulating the flames so as to be as nearly the same size as possible. I measured, by the method of shadows, the comparative intensities of light, which I found to be as seven to five in favor of the prepared oil. This burned

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with a flame of peculiar richness, plainly exceeding in density that from the simple oil; but after two hours, the flame of the prepared oil began to decline slowly, and soon became inferior to the other, an effect which doubtless arose from the clogging of the wick.

I had hoped, on account of the perfect solution which the resin seemed to undergo, that the compound would burn freely without encountering this impediment, but in this respect I was disappointed, and can only say, that if some means can be devised for avoiding the tendency to clog the wick, the addition of a small portion of resin to lamp oil or lard will add essentially to its value for burning in solar lamps, by rendering it less liable to congeal, and by increasing its illuminating power.

AMMONIA IN THE AIR.*

BY PROFESSOR E. N. HORSFORD, OF CAMBRIDGE, U. S.

THE source of nitrogen in plants has been ascribed to the ammonia of the atmosphere brought down for the most part by rain falls; retained in the soil by virtue of its porosity and its moisture, and thus applied to the subterranean absorbents of plants. To some extent, it has doubtless been supplied through the foliage from the same great source. The determination by Kroker of the amounts of ammonia in soils from various localities, uncultivated as well as cultivated and manured, showed the abundant supply of this body in the earth. Nevertheless, the determination of the ammonia in the air, whence it was conceived the stones in the soil must be derived, have uniformly yielded too little to satisfy the demand which the larger drafts for grain crops have made. The qualitative detection of ammonia in the air has been made by Schule, De Saussure, Coloro de Martigue, Faraday, Zimmermann, Brande, Chevalier and Liebig.

A block of ice, from the foot of the glacier de Boisson, Chamouni, and which, according to Murray, is one of the termini of the Mers de Glace, when melted, gave 8·8 litres of water, and 0·0177 grains of ammonia, or about 2·1·000·000 of the weight of the ice was ammonia. The determination of Fraezer gave for one million grammes of air, 0·323 of ammonia. That of hemp for an equal volume of air, 3·68 grains of ammonia. Fresenius found in an equal volume, by day, 0·098 grains of ammonia, and by night, 0·169 grains of ammonia. The method pursued by Graeger and Fresenius was the same. With the aid of an aspirator, they transmitted large volumes of atmospheric air through dilute hydrochloric acid, and evaporated the solution, to which bichloride of platinum had been added, to dryness, determining the ammonia in the usual manner. (Professor Horsford here proceeded to detail the processes of Fresenius, and some improvements of his own, with diagrams.) The chief conclusions to which the determinations of the ammonia in rain water and snow directed attention were the following:—

That an equal weight of snow water contains more ammonia.

That the quantity brought down by the snow, compared with that in the space from which the snow fell, is exceedingly small.

A number of tables were given by Professor Horsford in demonstration of the results obtained, one of which is here inserted:—

TABLE SHOWING THE VARIETIES IN THE QUANTITY OF AMMONIA IN THE AIR.

		In 1 metre.
1849.	July 3	40·36
	—— 9	55·05
	September 1—20	29·79
	October 11	28·84
	—— 14	25·85
	—— 30	13·19
	November 6	6·78
	—— 10, 12, 13	7·16
	December 17	6·25
	—— 20, 21	7·11
	—— 29	2·45
1850.	January 15	23·10
	—— 30	9·22
	February 15	7·72
	March 1	13·47
	—— 15, 16	11·10
	—— 30	3·55
	April 15	28·77
	—— 29, 30	16·18
	May 14, 15	12·67
	June 6	4·43
	—— 17, 20, 21	7·88
	—— 22	36·43
	—— 29	9·89
	July 5	4·19
	—— 10	2·29
	—— 15	12·36

The following are the conclusions from the results:—

1. The quantity of ammonia on the air is variable.

2. There is more apparently as a general statement in the air of a south-west wind.

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3. The quantity is augmented by animal and vegetable decompositions.

4. As the moisture was ascertained last year to be greatest during a south-west wind, there would seem to be connection between the exhalation of moisture and that of ammonia from the soil.

ON THE ASSUMED EXISTENCE OF AMMONIA IN THE GENERAL ATMOSPHERE.*

BY DR. A. A. HAYES.

The object of this paper was to show that ammonia is not found to be a general constituent of the atmosphere, but that the ammonia found by chemical analysis of the air near the surface of the earth is derived from an organic substance discovered by Zimmermann, and called by him pyrrhine. To this substance, which exists universally in rain and snow water, Dr. Hayes attributes the fertilising effects of snow, rain, and the water contained in arable soils. He adduced instances of very rapid vegetation as produced by the formation of pyrrhine in fermenting mould.

Dr. Hayes regards ammonia as being a poison to plants, though he attaches great value to it as a neutralising agent to acids of soils, and as serving to convey other ingredients, such as carbonic acid and the organic acids of soils, into the circulation of plants.

Dr. Jackson sustained the views of Dr. Hayes as to the state of ammonia producing substances in the air.

DIMORPHISM OF COPPER.†

BY W. P. BLAKE, ESQ.

MR. BLAKE stated that the result of some electrotype experiments was the production of crystals of copper, not of the monometric system, but in small hexagonal prisms. The faces of the terminal planes being small, the angles could not be conveniently measured, and Mr. Blake had endeavored to produce larger crystals before deciding upon the system to which they should be referred. He had since seen a crystal of native copper from South America, in form a hexagonal prism with one terminal plane, nearly three-quarters of an inch in diameter. There is, therefore, good evidence of the dimorphism of this metal.

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† Ibid.

NEW INVESTIGATIONS ON THE PRODUCTION OF SUCCINIC ACID BY MEANS OF FERMENTATION.*

BY M. DESSAIGNES.

WHEN I briefly made known to the Academy the transformation of crude malate of lime into succinate of lime by spontaneous fermentation, I propose to add to this first observation the facts which analogy might reveal. This investigation was rather far advanced when Professor Liebig published a memoir on the same subject. I should have abandoned my work, had I not discovered some facts which were not observed by the celebrated chemist of Giessen.

I used crude cœsein as a ferment; I mixed it intimately with water holding in solution or in suspension the matter to be experimented on, and I abandoned the whole to the ordinary temperature of summer for three weeks or a month. My experiments were made on the neutral and perfectly pure malate of lime, acid malate of lime, malate of potassa, the aspartate of potassa and lime, fumarate of lime, maleäte of lime, and the aconitate of lime, extracted from the Aconitam napellus. All these salts are readily converted into succinate, under the influence of the fermentation of the casein. Asparagine, under the same influence, begins by changing into aspartate of ammonia, which is converted into succinate. Indeed, if the fermentation be interrupted before it is finished, a great quantity of aspartic acid as well as succinic acid is formed in the liquid.

The body not yet isolated which remains in the family of the Leguminæ, and which is converted by germination into asparagine, is also susceptible of being transformed into succinic acid. Indeed, if pea flour be digested in water for twelve hours, and left to fermentation, after having added chalk to it, and having filtered the liquid, a considerable quantity of succinate of lime is found in it. I have fermented separately legumine, the liquor from which it had been precipitated, and also a nitrogenous body which precipitates tannin, and which was noticed by M. Braconnot. I hoped thus to discover the body which produces succinic acid. All these experiments give succinic acid in, it is true, unequal quantities, but I have not yet concluded this part of my investigations. I have also produced the same acid by the fermentation of the emulsion of sweet almonds, separated from its oil and mixed with chalk. It appears,

* *Comptes Rendus*, No. 12, Sept. 16, 1850.

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then, that the succinic fermentation will be met with in nature as frequently as acetic, metacetic, butyric and valerianic fermentations.

I will now add a word on the isomeric acids of the formula.

$$C^4 H^2 O^4$$

As has been seen above, fumaric, maleïc, and aconitic acids are likewise converted into succinic acid; this similarity of transformation is remarkable, for, on one hand, the citrates of lime and soda, fermented with caseïn, do not give succinic acid, and, on the other hand, the two acids derived from malic acid are very clearly distinguished from aconitic acid by another metamorphosis. Indeed, I have found that bifumarate and bimaleate of ammonia, submitted to dry distillation, give a matter very similar in most of its reactions, but not identical with that which bimalate of ammonia produces in the same circumstances. This matter, by the prolonged action of hydrochloric acid is converted into aspartic acid, which is absolutely the same as that which is obtained with malic acid. Now, the biaconitate of ammonia and the bicquisetate of ammonia, submitted to the same treatment, do not produce aspartic acid. The neutral maleate of ammonia does not precipitate chloride of iron, whilst the neutral aconitate and equisietate of ammonia do precipitate the same salt. In the comparative study of these three acids which I have commenced, I was easily enabled to convince myself of the complete identity of aconitic and equisetic acids, and of the non-identity of the latter acid and maleic acid; but the details which I might give in this respect are rendered unnecessary by the recent publication of M. Baup on this subject. (See p. 52 of the present No.)

I will conclude by pointing out a means of obtaining, with asparagine, aspartic acid crystallising under the same form as aspartic acid obtained from bimalate of ammonia. Aspartate of ammonia produced from asparagine is heated to 392° F. until the ammoniacal odor is no longer perceived; a brown and sparingly soluble matter remains which, treated by hydrochloric acid, reproduces aspartic acid crystallising in short and hard prisms, like those of the acid derived from malic, maleic and fumaric acids.

THE TENACITY OF METALS.*

BY M. BAUDRIMONT.

THE results of numerous experiments have led M. Baudrimont to the following conclusions:—

1. That the tenacity of metals varies with their temperature.

2. That it generally decreases, with some exceptions, as the temperature rises.

3. That in the case of silver the tenacity decreases more rapidly than the temperature.

4. That the tenacity of gold, platinum, palladium and copper diminishes less rapidly than the temperature.

5. That the case of iron is very peculiar and remarkable: at 212° F., its tenacity is not so great as at 32° F.; at 392° F., however, its tenacity is greater than at 32 F.°

Comptes Rendus, July 29, 1850.

THE ASHES OF ANTHRACITE COAL.*

BY MR. JONATHAN B. BUNCE.

COAL, now so common an article of fuel in all our cities, leaves but a small quantity of ashes, yet when we take into account the number of tons consumed in a single year, this amount becomes very considerable; hence it becomes a matter of interest to know whether it can be considered of economical value. With this purpose in view, two samples of coal were selected, the white and red ash varieties, and the quantities soluble both in water and acid determined with the following results, viz.:—

White ash in water.....	3·74
White ash in acid.....	17·07
Red ash in water.....	3·35
Red ash in acid.....	18·65

The following analysis is the mean of two determinations of the portion soluble in acid:—

	White ash.	Red ash.
Soluble silica...	·796	8·621
Alumina.....	35·201	29·575
Iron.....	29·643	40·614
Lime.....	18·655	1·108
Magnesia.....	1·730	13·992
Soda.....	1·933	1·146
Potassa.....	1·443	·732
Phosphoric acid	1·796	1·880
Sulphuric acid..	8·164	3·010
Chlorine.....	·087	·013
Total....	99·448	100·691

The results obtained in these two analyses seem to justify the extensive use of coal ashes for agricultural purposes; they are very valuable on account of the sulphates of lime and magnesia which they contain, and also from the phosphoric acid and alkalies. Hundreds of tons which are now wasted might thus be brought into use.

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ON APIINE.*

BY DR. VON PLANTA AND W. WALLACE.

THE apiine was prepared by these gentlemen by exhausting fresh parsley several times with boiling water, straining the liquor through linen, and drying the gelatinous substance separated by cooling, on a water-bath. This produced a dirty green powder, which was exhausted frequently with boiling alcohol. On cooling, the filtered solution formed a jelly, distillation removed the alcohol, and the sediment was collected on a cloth. The color of the substance after pressing was a greenish white. It was then wetted with hot alcohol and pressed several times, and the residue treated with ether until it removed nothing further; when thus purified, the authors call the substance obtained apiine. Some apiine remains in the alcoholic liquors, but this may be separated by distilling off the alcohol and digesting the residue with ether. In this manner a dark green solution is obtained, which, on the evaporation of the ether, gives a green varnish containing chlorophylle and a waxy matter. When this green varnish is boiled in water it melts, and afterwards congeals into a brittle shining mass, which melts at 140° and saponifies with difficulty if boiled with caustic potassa.

Apiine, (C^{24} H^{14} O^{13},) is a soft colorless powder, possessing neither flavor nor odor; by drying over sulphuric acid at 212° it loses 4·21 per cent. of water, but on exposure to the atmosphere absorbs the same quantity. Heating from 212° to 356° F. does not alter its weight; at the latter point it melts very rapidly into a mass, which, when cold is yellow, brittle, and has a vitreous lustre. It decomposes between 392° and 410°. When apiine which has been carefully melted is mixed with boiling water it dissolves with greater readiness than if it had not been fused, and on cooling forms a firm, transparent jelly, therefore fusion produces no change either in its composition or properties. It melts very quickly on platinum foil, takes fire, puffs up, and carbonises, leaving 0·15 per cent. of ash. Apiine is difficultly soluble in cold water, one part requiring 8500 parts of water, but readily soluble in boiling water. One part of apiine, dissolved in 1537 parts of boiling water, formed, on cooling, a weak gelatine. It will dissolve in 389 parts of cold alcohol, but more easily in boiling alcohol. If the alcoholic solution be not too dilute, the apiine will gelatinise from it on cooling in the same manner as from an aqueous solution.

When protosulphate of iron is added to a solution of apiine it produces a blood red color, which, with pure apiine, disappears only with a dilution of 8500 times. Braconnot says that one centigr. of apiine when dissolved in 20 quarts of boiling water, produced a liquid which had a reddish appearance on the addition of only one centigr. of protosulphate of iron. No precipitate is produced in the solutions of apiine by chloride of barium, acetate of lead or nitrate of silver; an alcoholic solution of lead produces in an alcoholic solution of apiine an intense yellow color.

Apiine will not form any regular compound with the metallic oxides, and the precipitates produced by salts of lead furnish a varying amount of lead; 53·60 per cent. of oxide of lead being obtained in one experiment and 61·09 per cent. in another. Different preparations of apiine gave the following analyses:—

					Per cent.
Carbon..	24=144	55·25	55·05	54·71	54·06
Hydrogen	14	14	5·59	5·49	5·60 5.34
Oxygen..	13	104	39·16	39·46	39·63 39·70

THE ALTERATION OF APIINE BY BOILING IN WATER.

When boiled for a long time in water apiine absorbs 2 atoms of water and loses its gelatinising properties. When cold it is brittle and easily reduceable to a brown powder; it dissolves in boiling water with great ease, but does not gelatinise on cooling. It does not melt on platinum like pure unaltered apiine. The same red color is produced on the addition of protosulphate of iron to its alcoholic and hot aqueous solutions. A slight muddiness is caused by the addition of chloride of barium to the hot aqueous solution; acetate of lead produces a copious precipitate, which does not dissolve by boiling. Nitrate of silver causes no change. The modified apiine which separates as a light, flocculent, almost colorless precipitate, gave the following analyses:—

			Per cent.
Carbon.....	24=144	50.98	51·43
Hydrogen..	16	6·03	5.71
Oxygen....	15	120	43·09 42·86

APIINE AND DILUTE MINERAL ACIDS.

By dissolving apiine with heat in dilute sulphuric acid and then boiling the solution for about twenty minutes, it is converted into a substance which contains 4 atoms less water than apiine; it precipitates

* Liebig's *Annalen der Chemie und Pharmacie.*

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on cooling in whitish flocks shrinking perceptibly on the filter. When pressed between blotting paper, dried over sulphuric acid, and then in the water bath, and pulverised, it is pale brown. No difference was perceptible in this substance whether boiled for half an hour or for the whole day. It likewise formed when the water contained only 1 per cent. of sulphuric acid. Apiine thus modified is almost soluble in a volume of boiling water which would have dissolved this substance with ease when unaltered, even twelve times the amount dissolved very little of the brown powder. That which dissolves separates when cold in white flakes, the length of which varies in proportion to the volume of water used, and the length of the ebullition.

This substance dissolves easily in boiling alcohol, but does not separate on cooling. Both these solutions have a neutral reaction, and in either protosulphate of iron produces a reddish brown floculent deposit. Chloride of barium, acetate of lead and nitrate of silver produce no change. It melts at a higher temperature than pure apiine, and then not without decomposition.

The following is the analysis :—

			Per cent.		
Carbon..	24=144	63·67	63·34	63·45	63·71
Hydrogen	10	10	4·41	4·56	4·55	4·42
Oxygen..	9	72	31·92	32·10	32.02	31·87

Apiine yields no sugar when boiled with dilute sulphuric acid.

Apiine, after boiling for half an hour with dilute hydrochloric acid, produces a substance having the same composition as if prepared with sulphuric acid, but other properties. On pouring the dilute acid over the apiine, it assumes a yellow color, retained by the solution ; but when boiled, it becomes turbid, and there is soon a whitish flocculent precipitate which continued boiling does not dissolve. On the filter, it retains a loose form and does not shrink so much ; the dried powder is light brown. This substance dissolves far more readily in water than that obtained with sulphuric acid under the same circumstances. The hot aqueous solution is of a yellowish color, does not gelatinise on cooling, but is colorless after the deposition of a copious precipitate ; this dissolves readily with boiling alcohol, and, similarly to that obtained with sulphuric acid, remains in solution after long standing. Protosulphate of iron causes a brick-red color in the aqueous and alcoholic solutions, and deposits a reddish-brown precipitate, which is not dissolved when boiled, nor is the liquid decolored. Acetate of lead causes a slight precipitate in a hot aqueous solution ; nitrate of silver and chloride of barium have no effect. The following is the analysis :—

			Per cent.	
Carbon.....	24=144	64·36	63·71
Hydrogen...	10	10	4·54	4·42
Oxygen.....	9	72	31·11	38·87

APIINE WITH CONCENTRATED MINERAL ACIDS.

Apiine dissolves in concentrated sulphuric or hydrochloric acid without heat. A floculent yellowish substance is precipitated by water, which when pulverised is of a yellowish brown color. It contains 2 atoms less water than pure apiine. With sulphuric acid, apiine, when heated, is blackened : there is an evolution of sulphurous acid, and the clear solution formed with hydrochloric acid becomes turbid with heat, and there is an abundant dark brown flocculent precipitate. The analysis of the matter precipitated by water from the cold solution in sulphuric or hydrochloric acid gave :—

			Per cent.	
Carbon. . . .	24=144	59·06	59·01
Hydrogen . .	12	12	5·08	4·91
Oxygen. . . .	11	88	35·86	36·08

APIINE WITH ALKALIS.

Potassa and ammonia readily dissolve apiine, and acids remove it from the solution in a gelatinous, unaltered condition. With dilute caustic potassa, the solution was of an orange red color. The precipitate with an acid from the solution had a similar composition to that of apiine, namely :—

			Per cent.	
Carbon . . .	24=144	54·87	54·96
Hydrogen. .	14	14	5·73	5·34
Oxygen . . .	13	104	39·40	39·70

APIINE WITH CHLORINE.

Chlorine passed into a hot aqueous solution of apiine produces a dirty yellow precipitate which contains chlorine. In hot alcohol or water, its solution is neutral ; the latter deposits, on cooling, a yellowish flocculent precipitate. Protosulphate of iron produces in the hot aqueous solution a blood red color, which boiling does not remove ; and acetate of lead, an abundant yellow flocculent precipitate which is not dissolved by ebullition.

APIINE AND HYDROCHLORIC ACID GAS.

Apiine being exposed at 212° F. to a current of dry hydrochloric acid gas, acquires a yellow color, which disappears on the addition of heat ; it increased in weight, in one experiment 5·111, and in another 5·132 per cent.

APIINE AND NITRIC ACID.

Braconnot states that apiine with nitric yields nitropicric and oxalic acids. Our authors have found this correct with respect

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to impure apiine, but not with the pure substance.

Apiine distilled with manganese and sulphuric acid, produces carbonic, formic and acetic acids.

RESEARCHES ON THE IODINE OF FRESH WATER—ON THE PRESENCE OF THIS BODY IN TERRESTRIAL PLANTS AND ANIMALS.*

BY M. AD. CHATIN.

1. THE existence of iodine in certain aquatic plants of Europe, Asia, Africa, America, and New Holland, confirm that which we have deduced from the analysis of the species of the environs of Paris, namely, the presence of this body in the mass of the globe, and the generality of fresh waters.

II. The state of the earth at the periods of the old vegetations might be deduced from the proportion of iodine in their fossil remains. Coal, which is rich in iodine, must arise from plants developed on land still washed by the sea; in anthracite, which contains less iodine than coal, we find that terrestrial vegetables have become mixed with the cryptogamic plants of the coal mines; and the lignites, which contain little or no iodine, show that the terrestrial species predominate over the crust of the globe, commencing with the waters. Iodine appears in the lixivium of turfs; and its abundance in graphite seems finally to show that this substance should be classed among products of organic and aqueous origin. Anterior to the coal formation, graphite would represent the oldest vegetation of the globe.

III. Fresh water animals contain iodine; they even contain more than the plants which grow in the same water.

IV. The presence of iodine in fresh water may be directly ascertained. From experiments made in this respect on about three hundred rivers, springs and wells, it may be concluded, in general:—

1. That iodine exists, in variable proportion, in all the waters of the globe.

2. That the richness of the waters in iodine may be presumed according to the more or less ferruginous nature of the lands which they wash.

3. That the proportion of iodine ordinarily increases in water with that of iron, so that the waters which are called ferruginous might just as properly be called ioduretted waters.

4. That the waters of igneous earths are more ioduretted, on the average, and especially more uniformly, than those of sedimentary earths.

5. That the waters of the green chalk and of ferruginous oolite occupy the first rank among the latter: they may even be placed before those of igneous earths.

6. That although rich in iodine the waters of the coal formation come after those of certain igneous earths or ferruginous sediment.

7. That the waters of essentially calcareous and magnesian earths contain very little iodine.

8. That iodine is especially rare in iridescent marls, the ordinary gangue of rock salt.

9. That the iodides are not necessarily proportional to the chlorides.

10. That the rivers supplied by glaciers (the Rhine, Rhone, Isère, Durance, Tet, Garonne, Adour, &c.) are less ioduretted, especially at the period of the melting of the snow.

11. That the waters of rivers are, on the average, more ioduretted, less charged with earthy salts, and especially more uniformly ioduretted than those of springs.

12. That the waters of wells are at once most calco-magnesian and least ioduretted.

V. The proportion which exists between the iron and the iodine of waters, the easy decomposition of the iodide of iron, and the complete decomposition of the iodide of the waters in evaporation without the addition of potassa, render it probable that the iodine exists in them in the state of iodide of iron.

VI. Iodine exists in terrestrial plants and animals.

VII. The potassa of commerce, and most of the salts formed from it, contain iodine; but nitrate of potassa, cream of tartar, emetic, and the double tartrate of potassa and soda, contain none.

The ammoniacal salts and soda likewise contain iodine, as well as the chloride of sodium of the salt marshes which is reputed pure. Rock salt, and the salt springs of the east, are almost entirely free from iodine.

VIII. Fermented liquors contain iodine.

Wine, cider and perry are more ioduretted than the average of fresh water.

Wines vary, like water, according to the nature of the soil. Among those observed, the richest in iodine came from the granitic coasts of Mâconnais, of Beaujolais, and from the oolite of Tonnerre; the poorest from the white chalk of Champagne. The Bordeaux wines of the tertiary soil of the Gironde are less ioduretted than the wine

* *Comptes Rendus*, No. 9, Aug. 26, 1850.

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from the great band of green chalk which extends from the environs of Cahors to those of Rochelle.

IX. Milk is still richer in iodine than wine, and asses' milk is richer than that of the cow.

Independently of the soil, with which it varies, the proportion of iodine in milk is in the inverse ratio of the abundance of that secretion.

Eggs (not the shell) contain much iodine. A fowl's egg (weighing 50 grmmes) contains more iodine than a quart of cow's milk: it contains as much as two quarts of wine or good water (that of the Seine at Paris).

X. Iodine exists in arable land: it is abundant in sulphur, iron and manganese ores, and sulphuret of mercury; but rare in gypsum, white chalk, calcareous and silicious earths, &c.

XI. Any attempt to extract iodine economically should be made with the plants of the ferro-ioduretted fresh waters.

XII. Too small a proportion of iodine in the drinkable waters of certain countries appears to be the principal cause of goitres. Change of water, and at least the use of wine, of ferro-ioduretted waters, cress and good water, animal food, especially eggs, are rationally indicated in this affection. It would also be advisable, in countries where goitres prevail, to substitute the salt of salt marshes for the rock salt commonly found and consumed in them.

Most of the bodies regarded by therapeutists as pectoral and antiscrofulous are rich in iodine.

ON THE ESTIMATION OF FLUORINE.

BY H. ROSE.*

When it is necessary to estimate fluorine in dry combinations, the best method is that which Berzelius first employed, and which consists in decomposing the fluorides by sulphuric acid, and in driving off the hydrofluoric acid by means of heat.

When the fluorine is contained in a solution, it is ordinarily precipitated in the state of fluoride of calcium. If the precipitate is gelatinous, the liquor should be boiled. It has been the custom, when the liquor is acid, to neutralise it with ammonia before precipitation. Professor Rose demonstrates that it is better to employ carbonate of soda for the neutralisation; for the fluoride of calcium is not insoluble in the ammoniacal salts which are separated by acetic acid. The precipitate contains in this case, carbonate of lime and fluoride of calcium. The fluorine may also be precipitated in the state of fluoride of barium or lead by pouring into the liquor nitrate of baryta or lead, and afterwards diluting with an equal bulk of concentrated alcohol. The precipitate is washed with alcohol. The fluoride of barium is weighed after calcination: that of lead, on the contrary, which is as volatile as chloride of lead, should be dried at 212° F.

The estimation of fluorine in some insoluble fluorides, is not free from difficulty. The fluoride of calcium, in particular, is not decomposed when calcined with carbonate of soda. To effect the decomposition, it is necessary to add silica. The fused mass, solidified by cooling, is treated with water, and the silica is precipitated from the solution by carbonate of ammonia. The liquor then contains fluoride of sodium which may be precipitated by chloride of calcium, observing the precautions which have just been pointed out.

When the matter to be analysed contains phosphates as well as fluorides, the analysis is very difficult. It is, indeed, impossible to decompose with carbonate of soda and silica the insoluble fluorides which are found in presence of phosphate of lime. In presence of phosphate of alumina the decomposition takes place: all the phosphoric acid and all the fluorine pass into solution, when the calcined mass is treated with water. We then precipitate by means of chloride of calcium, the carbonate of lime is removed with acetic acid, the mixture of phosphate of lime and fluoride of calcium is weighed after having been dried, and is decomposed by sulphuric acid, in a platinum vessel. The hydro fluoric acid is disengaged, the phosphoric acid remains in the residue with the sulphate of lime, they are separated by alcohol, estimated by known processes, and we find as the difference the quantity of fluorine disengaged in the state of hydrofluoric acid.

* *Annalen der Chemie und Pharmacie.*

ARTIFICIAL CRYSTALS OF SESQUI-OXIDE OF CHROMIUM, Cr^2O^3.*

BY MR. WM. P. BLAKE.

Mr. B. showed to the Association several specimens of crystallised oxide of chromium of great beauty. They were formed in a reverberatory furnace, long used to manufacture chromate of potassa from chrome iron ore. The crystals were small, of a deep

* American Association for the Advancement of Science.

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emerald green color, and in hardness next below the diamond. Mr. Blake considers their formation due to the infiltration among the bricks, of the fused chromate of potassa, and the subsequent decomposition of the potassa, by long-continued and uniform heat, and the reduction of the chromic acid to sesquioxide of chromium.

INFLUENCE OF THE BILE ON THE FORMATION OF FAT IN THE ANIMAL ORGANISM.*

BY DR. VAN DEN BROCK.

In a dissertation published in 1845, Meckel considered that he demonstrated that bile has the property of converting grape sugar into fat; but it was ascertained that the substance obtained by Meckel in digesting grape sugar in bile at the temperature of the human body, was not fat.

Dr. Van den Brock has made some experiments which lead to the following results:—

1. Neither chemical researches nor microscopical investigations furnish any proof that fresh bile converts grape sugar into fat.

2. The formation of lactic acid from grape sugar digested in fresh bile admits of no doubt. This lactic acid separates the fatty acids and the acids of the bile from their combinations, and as the latter dissolve equally well in absolute alcohol and in ether which contains water, they augment the quantity of ethereal extract. The biline also is separated by ether which contains water, but very sparingly by absolute ether.

3. During the digestion of fresh bile, without sugar, or with grape sugar, carbonic acid is developed in variable quantity in both cases. The first case proves that free carbonic acid or double carbonates exist in the bile; the greater part of the carbonic acid which is developed under the influence of grape sugar, is explained by the conversion of the sugar into lactic acid, a conversion which is accompanied by a disengagement of carbonic acid, and by the decomposition of the carbonates of the bile by the lactic acid.

NEW TEST FOR THE NITRATES.†

BY PROFESSOR SCHÆFFER, OF KENTUCKY.

Mr. Schæffer's process consists in adding to the solution supposed to contain nitrates, one or two drops of yellow prussiate of potassa (these should not be enough to give a perceptible tinge to the liquid); a few drops of acetic acid are then to be added, and immediately, or in a few minutes, according to the quantity of nitrate present, the liquid assumes a rich yellow tint.

* *Gazette Médicale.*

† American Association for the Advancement of Science.

ON DUMB-BELL CRYSTALS OF URIC ACID DISCOVERED IN THE URINE.*

BY MARRIS WILSON, M.D.

The most remarkable and curious of all the formations which occur in urine is the dumb-bell, attention to which was first drawn by Dr. Golding Bird, by whom it was described as a condition peculiar to oxalate of lime. More recently, Dr. Hassall (see *The Lancet*, vol. i. 1850, p. 177) has pointed it out as a form assumed by other oxalates, and also by soda and potassa in combination with sulphuric acid.

Having been for some time past engaged in the analysis of urine, in a variety of diseases, I was led to make a series of experiments, for the purpose of determining the condition of the urine favorable to this formation; and in the course of these observations was enabled to determine the following interesting facts:—

Firstly. That dumb-bell crystals are very frequently developed, as the result of certain modifications of uric acid.

Secondly. That it is not to the salts of urine alone that this formation is confined, for I have frequently met with it in solutions which had no organic origin, and in a variety of salts.

I should perhaps premise, that although Nature seems to accomplish her ends without effort or excess, and sometimes most unexpectedly, it is occasionally very difficult, in prosecuting experiments, to arrive at satisfactory results. I am led, however, to the conclusion, that the form of the dumb-bell crystal depends upon a specific but independent force, developed under certain determinate circumstances, consentaneously with that of homogeneous attraction or aggregation.

I have observed, that when spicular crystals commence forming upon a centre, after stretching some little distance in a straight line, they begin to branch and spread outwards; and that as this lateral force is more or less vigorous, that of extension is arrested, and the tuft of spiculæ spreading from the central point, assumes the flattened globular shape, in a proportionately

* *The Lancet*, October 19, 1850.

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complete degree, and the same action taking place at both ends of the primary crystal, constitute the dumb-bell form. It appears to me that this effect arises purely from the agency of electricity; and that, as an arranging power, it is quite separate and distinct from that of aggregation, and depends for its influence upon the repulsive force manifested towards each other by similarly electrified bodies.

The first effect of consolidation in the crystalline centre is the production of a small amount of electrical action, sufficient in itself to cause two especial points of that centre, when it is the basis of a future dumb-bell, to assume a mutual repulsion.

This compound formative power, being directed on two opposite points of the mass, will continue until arrested by consolidation.

As the electrical or arranging force predominates, a limit will be fixed to the longitudinal extension of the crystals, and proportionately the lateral arrangement propagated, until a more or less complete dumb-bell is produced.

Occasionally this latter action is so powerful as to fill up with spiculæ and consolidate the entire space around the centre of crystallization.

But it is not my intention to enter into the very interesting subject of crystallization generally, many new phenomena of which actual examination by the microscope has taught me, but to confine myself to the form and construction of the dumb-bells of uric acid. Uric acid and oxalate of lime occur very frequently together in the same deposit, and from their combined presence very different forms of dumb-bell crystals are found together; it is therefore of the first importance to separate each salt carefully, before proceeding to subject it to experiment.

While analysing some urine of high specific gravity, and in which there was a copious precipitate of uric acid, I added a solution of caustic potassa in sufficient quantity to dissolve the deposit. The urine thus treated was twice filtered; a light flocculent cloud of uric acid, in combination with potassa, made its appearance in a short time, and gradually subsided to the bottom of the vessel. The supernatant fluid being decanted off, hydrochloric acid, in great excess, was poured suddenly upon the sediment, which, after a rest of about a quarter of an hour, was found converted into a thin layer of opake dark brown uric acid dumb-bells. These differed in the most marked degree from the dumb-bell of oxalic origin by their great insolubility in water. But the experiment is open to the doubt that an oxalate might have gained entrance.

I then separated some highly crystallized uric acid from the urine in which it was deposited, and washed it thoroughly with large quantities of warm water; it was then dissolved in pure caustic potassa, and filtered through paper. On adding strong hydrochloric acid in excess to this solution, dumb-bell crystals were deposited, some being of very perfect form, others not so.

Some pure lithic acid was dissolved in concentrated sulphuric acid; to this solution two-thirds of water were added, and there occurred an instantaneous precipitation of imperfect dumb-bells. To show the difficulties of this kind of demonstration, and the changes likely to result from varied circumstances, a small quantity of this concentrated sulphuric solution being dropped into a large bulk of water, the resulting deposit consisted of thin broad plates, the two edges of which, in the longitudinal direction of the spiculæ, were considerably thickened, forming ridges; but these plates, when rolled over on their thin edges for examination, also presented a dumb-bell form, though from their narrowness it was impossible to retain them on the edge.

The dumb-bells to which I wish to call attention and give a description are those obtained in the deposit caused by the addition of hydrochloric acid to the potassa solution. My reason for so doing is because I have observed the same forms as a natural deposit among uric acid; and these, although of such a remarkable form, have, I believe, until the present time, been left undescribed.

They consist of a thin translucent plate, of an oval or rhomboid form, having a slightly elevated ridge running along their middle in the direction of the long diameter, and from near the extremities of which extend two compact kidney-shaped crests of thin spicular crystals, their long diameter being across the plane of the translucent plate. A transverse section of one of the kidney-shaped crests would present an oval outline.

From the way in which the weight is arranged—namely, in the centre of the crests—the crystal has, while under the microscope, a tendency to float with the edge of the thin plate turned toward the eye of the observer. Circumstances, however, occasionally seem to dispose the face of the thin plate to be directed upwards, and then, without a close and careful examination by rolling the crystals over, their dumb-bell shapes might escape the eye of the micros-

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copist, and seem to represent only rhomboid plates of uric acid.

In the hydrochloric deposit, there was considerable variety of size, the following being measurements made with one of Powell's large microscopes :—

Long diameter of the largest crystals		..	$\frac{1}{650}$
Ditto	ditto	smallest	$\frac{1}{900}$
Long diameter of the largest crests		..	$\frac{1}{750}$
Short	ditto	ditto. ..	$\frac{1}{1500}$
Long	ditto	smallest crests..	$\frac{1}{1800}$
Short	ditto	ditto ..	$\frac{1}{2000}$

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON A MODE OF PRINTING IN COLORS ON TISSUES.*

BY M. CH. BROQUETTE.

An egg boiled in a color-bath, immediately takes the color of the bath. Every one knows this operation which is a very common one, and is much used about Easter time, but I do not think any one has explained the theory.

Why does the egg-shell become colored, and why are the bones of animals which have eaten madder colored with it? Such was the question the solution of which has been undertaken by M. Broquette, a manufacturing chemist, to whom the tissue manufacture has been indebted for the chief part of the progress made in it during the last twenty years.

There are in the egg-shell, as in bones, two distinct matters, the mineral salts and the organic tissues; the action of these matters may be considered separately. The mineral principle of the egg is carbonate of lime; that of the bone is phosphate of lime mixed with a little carbonate. The attempt to dye these mineral salts will fail, whether procured from egg-shells or from natural bones, or if artificially produced; neither of these inorganic substances will serve as mordants to the color.

If, on the contrary, this experiment is tried on the organic principle of the egg or of the bone, the substance will immediately take the color of the bath.

These experiments prove that the properties of taking the color in the egg-shell and bones belong not to the mineral salts, but to the organic tissue, which thus acts as a true mordant; it is an organic mordant.

There is but one step from this conclusion to the application. In the same manner that cotton covered with mineral mordants takes colors attracted by those mordants, so likewise will cotton covered with this organic mordant take the colors attracted by the organic mordant. It remained to discover a means of fixing the organic matters of the egg and bones upon the cotton, or rather some analogous substances, such as albumen, gluten, fibrine, or caseïne, which are all organic mordants. M. Broquette prefers caseïne.

It is necessary to render the caseïne soluble, so that it may penetrate the tissue, and then to render it insoluble that it may not be removed. Braconnot has shewn that caseïne is dissolved in ammonia and that the compound of caseate of ammonia is again separated by heat. M. Broquette has turned this observation to practical use; he impregnates the cotton with caseate of ammonia, then, by heat, he drives off the ammonia and the cotton remains impregnated with insoluble caseïne. The cotton, thus animalised, may be dyed in the same color baths used for woollen tissues.

Still this preparation of the cotton is not always solid, for alkaline dyes are often used, and as caseïne is soluble in alkali, the mordant is likely to be dissolved; it is therefore important to fix it, and to render it as insoluble in the ley, as it is in water.

Bachelier had conceived the idea of mixing new cheese with lime to form the stone color which bears his name. He saw that lime first softens and dissolves the caseïne, and then renders it by degrees hard and insoluble.

M. Broquette combines caseïne with lime and uses them either with or without ammonia. He thus impregnates the cotton with caseate of lime instead of caseate of

* *Journal de Pharmacie et de Chimie*, April, 1850.

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ammonia, this with heat soon becomes insoluble; the mordant is thus fixed in a more complete manner, and resists the action of alkalis; still this preparation gives the tissue a certain stiffness, so that cotton which resembles wool in its ability to take colors, is far behind it in softness and lustre.

The use of oils in the preparation of cottons to be dyed of a Turkey red color, is well known. The fatty body penetrates the tissue and gives it transparency and softness.

M. Broquette applies this process: he adds emulsive oil to his organic mordant; the oil, caseïne and lime form an intimate union, penetrate the tissue, there become insoluble, and give it new qualities:—of attracting the same dye colors as wool, of retaining them as completely, and of nearly approaching wool in softness and brilliancy.

One difficulty remained to be overcome. Some tissues are made of wool and cotton, and it is above all for these that this organic mordant is especially useful. But how to apply it to the cotton without injuring the wool?

A mordant applied to the whole tissue would impregnate both wool and cotton, and whilst it destroyed the lustre and beauty of the wool, would not sufficiently penetrate the cotton. To avoid this difference M. Broquette applies the mordant before weaving; his mordant replaces the dressing, it impregnates the cotton in the spinning, and the cotton thus prepared may be woven and bleached like wool without the oil and caseïne retained by the lime escaping, without any of the properties of the mordant losing their intensity, and without the cotton losing its pliability; in fact, the tissue of wool and cotton has all the properties of wool.

It has been already said that the solution of caseïne with lime becomes insoluble even in alkaline water; this property M. Broquette finds useful to fix some powder colors on the tissue, such as ultramarine, the ochres, etc. He mixes those colors with the liquid preparation and prints with the mixture as with ink or oil colors. As long as the preparation remains liquid, the color may be removed by water, but as soon as the caseïne solidifies the whole adheres firmly to the tissues. In consequence of this property of caseïne M. Broquette has named it *caseo-gum*.

This is not a novel application; what is now done with caseïne has been hitherto done with white of egg; and we must observe that this first process, which dates from 1829, is likewise due to M. Broquette. The application of mineral colors by albumen or caseïne singularly simplifies the labor of printing on tissues, and assimilates the fabrication of printed tissues to that of painted papers, except that its powers are limited; it was impossible, in this way, to make use of the vegetable colors, which are so brilliant and so numerous in their tints. M. Broquette has, however, overcome this new difficulty, for he prints all the vegetable colors on woollen or cotton tissues, provided that the latter are animalised by his organic mordant.

Nothing can be more simple than his process; he precipitates the coloring principle in the state of lake with either alumina or tin, according to the nature of the substance, and places this chemical precipitate, (which contains the purest portion of the color,) without further preparation upon the tissue. When the printing is finished the tissue is wrapped in a moistened cloth, then exposed for half an hour to a humid vapor. This moisture and heat cause the color to penetrate the tissue gradually, and are essentially necessary, as if the tissue is simply dried with heat, the lake will harden and fall off, leaving no dye at all.

Certain dyes, orchil, for instance, which were only occasionally used before the introduction of these new processes, have received a great impulse from them. This will take place in even a greater degree in consequence of a very ingenious application lately made by M. Broquette. Some very beautiful colors are now obtained, the peculiar color of the orchil modified by lime.

The necessity of steeping the tissue in a lime bath to obtain the result desired, would of course limit the employment of this color, which could only be used with colors which the lime would not injure, but M. Broquette has avoided this difficulty by substituting magnesia for lime. The insoluble magnesia performs the same part as a base for which the lime was used and without presenting, like that substance, the inconveniences inherent to its alkaline nature.

These applications of mineral colors and lakes with albumen or caseo-gum enable us to obtain without dyeing designs in the richest colors which have but one defect; they have neither shades nor demi-tints; but although in this instance chemistry is at fault, M. Broquette has rendered his work perfect by mechanical means.

When a design is newly printed, he places the tissue on dry absorbant matter

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(cotton cloth) and presses the form on the back; this removes parts of the color and produces shades. He likewise obtains demi-tints by substituting curved for plain surfaces. It is unnecessary to enter farther into the description of these two processes of printing (chromastœnic and skiatypic) which render the method of which M. Broquette is the author so complete, and which will place his name in so honorable a rank in the history of chemistry and that of manufactures.

We cannot conclude this article without mentioning the name of Haussmann, a distinguished manufacturer, who opened the way by first thinking of the animalisation of cotton. His labors produced but one result, and were comparatively useless, but as having led to M. Broquette's experiments they merit a high place in the annals of science and the industrial arts.

Note—We wish, in connection with M. Broquette's work, to recall a well known fact which will find a natural explanation; we allude to the decoloration of red wine by bread crumb. Likewise the curious fact of a fraud on the custom house, which consists in declaring as port wine, sherry colored with alkanet root, which is afterwards decolored with caseine (from milk).

PREPARATION OF THE COLORS USED IN PAINTING ON PORCELAIN.*

THE following valuable recipes, for the preparation of the colors used in painting on porcelain, earthenware, &c., are those used by the principal color makers of the potteries.

Mat Blue.—Alumina, 30 parts; oxide of zinc, 5 parts; and cobalt, 5 parts. Mix, and fire to a biscuit heat, in an open crucible.

Mazarine Blue.—Alumina, 9 parts; oxide of zinc, 1½ parts; and cobalt, 1½ parts. Proceed as above.

Ultramarine.—Alumina, 28 parts; oxide of zinc, 7 parts; and cobalt, 7 parts. Proceed as above.

Sky Blue.—Alumina, 8 parts; oxide of zinc, 1 part; and cobalt, 1 part. If required of deeper color, add more cobalt.

Pink.—Oxide of tin, 21 parts; whitning, 9 parts; and yellow chrome, 1 part. Mix, and fire in biscuit dishes or tiles, one inch deep, not covered. This must have a grate fire.

Purple.—Oxide of tin, 18 parts; whitning, 9 parts; yellow chrome, 1½ parts; and cobalt, 1½ parts. Proceed same as for pink.

Yellow.—Tin ash, 20 parts; antimony, 10 parts; and litharge, 10 parts. Proceed as above.

Orange.—Crocus martis, 8 parts; antimony, 12 parts; and litharge, 8 parts. Proceed as above.

Brown.—Chromate of iron, 30 parts; and oxide of manganese, 6 parts. If wanted darker, add more manganese. Proceed as above.

Black.—Oxide of manganese, 3 parts; chromate of iron, 30 parts; and cobalt, 6 parts. Proceed as for brown.

Blue Green.—Alumina, 18 parts; yellow chrome, 4½ parts; bichromate of potassa, 4½ parts; sugar of lead, 4½ parts; borax, 1½ parts; and cobalt, 1½ parts. Mix, and fire in an open crucible—if covered, the colors separate from the borax, and silex used in this and the following.

Blue Green (No. 2).—Alumina, 15 parts; sugar of lead, 3 parts; yellow chrome, 6 parts; silex, 2 parts; cobalt, 1 part; and borax, 1 part. Proceed as above.

Victoria Green.—Silex, 9 parts; whitening, 6 parts; bichrome potassa, 9 parts; sugar of lead, 6 parts; borax, 3 parts; and yellow chrome, 9 parts. Proceed as above.

Albert Green.—Silex, 6 parts; whitening, 6 parts; bichromate of potassa, 6 parts; sugar of lead, 4 parts; and borax, 2 parts. Proceed as above.

Marune.—Pink color, 2 parts; and purple color, 1 part. Mix.

Gold Color.—Glass of antimony, 2 parts; red lead, 2 parts; and broken china, 1 part. The above mixed together, and fired to nearly a white heat in covered crucibles.

Grass Green.—Calcined flint, 3 parts; whitening, 2 parts; borax, 1 part; and green chrome, 1½ parts. Mix, fire as blue green—if wanted darker, add green chrome.

Pea Green.—Flint, 3 parts; whitening, 3 parts; yellow chrome, 2 parts; sugar of lead, 2½ parts; bichromate of potassa, 2½ parts; borax, 1 part; and cobalt, ¼ part. Proceed as above.

ENAMEL COLORS.

Rose.—Rose base, 1 part; oxide of silver, 3 parts; flux, No. 1, 40 parts. Grind together with spirits of turpentine for use.

Brown.—Brown base, 1 part; flux, No. 1, 3 parts. Ground together. This is good for common heats; but if for high heats, use flux, No. 2.

Black.—Black base, 1 part; flux, No. 1, 3 parts. Grind together, same as brown.

Yellow.—Yellow base, 1 part; flux, No. 1, 3 parts. Grind together.

* *Patent Journal.*

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Orange.—Orange base, 1 part; flux, No. 1, 3 parts. Grind together.

Chrome Green.—Chrome green base, 1 part; flux, No. 1, 3 parts. For ordinary heats; if for high heats, use No. 2 flux.

Blue Green.—Blue green base, 1 part; flux, No. 1, 3 parts. Grind together, same as chrome green.

Yellow Green and Grass Green.—Same proportions of base and flux as blue green.

Mat Blue.—Mat blue base, 1 part; flux, No. 1, 3 parts. Grind together.

Blue.—Blue base, 1 part; flux, No. 1, 3 parts. Mix, and fire twice at high heats, and grind for use.

Torquoise Blue.—Torquoise base, 1 part; flux, No. 1, 3 parts. Grind together.

Buff.—Buff base, 1 part; flux, No. 1, 3 parts.

Purple.—Base, 4 dwts. gold in solution; 1 dwt. tin. The above to be put together in ten times its weight of water, at 200° F.; and add (previously dissolved) 1 dwt. nitric acid, and 1 dwt. quicksilver. Wash the precipitate of gold and tin thus produced; 1 part of this base, 20 parts of flux, No. 1.

Enamel Flux, No. 1, for ordinary muffle heats.—Flint, 2 parts; borax, 4 parts; red lead, 6 parts. Mix, and fuse in a crucible until well finished boiling, and then grind for use. All the enamel fluxes may be poured into cold water.

Enamel Flux, No. 2, for high muffle heats.—Flint, 3 parts; borax, 4 parts; red lead, 5 parts. Fused same as No. 1.

Gold Flux.—Oxide of silver, 1 part; borax, 11 parts; litharge, 5½ parts. Fuse same as No. 1.

Flux for Blue.—Borax, 1 part; whitening, 3 parts; flint, 3 parts. The above fused to glass heat, and ground for use, falls out of the crucible like flour. The crucibles for all fluxes should be loosely covered, so as to admit air and exclude dirt.

Solution of Gold.—Gold, 5 parts; acids, 40 parts (the acids are to be mixed in the proportion of 1 part of nitric to 2 parts of hydrochloric acid). Dissolve.

Solution of Silver for Precipitate of Oxide of Silver.—Silver, 1 dwt.; nitric acid, 2 dwts.; water, 3 dwts. Dissolve the silver in the acid, and add the water.

Solution of Tin.—Same as solution of silver, substituting tin.

Gold Lustre.—Gold solution, 4 dwts.; tin, 1 dwt.; this thrown down by 2 parts muriatic and 1 of nitric acid; if the acids be good, 32 dwts. will be sufficient. For use, put to the above ½ oz. balsam sulphur.

Balsam for Lustre.—Linseed oil, 1 pint; sulphur, 2½ oz.; resin, ¼ oz. The powdered resin and sulphur to be boiled in the oil until the mixture acquires an orange tint on the surface.

Oil for Grounds.—Linseed oil, ½ pint; gum mastic in powder, ¼ oz.; red lead, ¼ oz. Boil over a slow fire until you can draw a thread from it a quarter of a yard long. This is used for sticking on the ornamental colors to the ware.

Oil for Printing.—Linseed oil, 1 quart; spirit of tar, ½ pint; resin, ½ oz. Mix over a slow fire, until you can draw a thread half a yard long.

Putty for Burnishing.—Take block tin and boil it in a crucible with a piece of iron, until you have a grey powder; this is pure putty powder.

China Body.—Calcined bones, ground fine, 300 parts; white clay, 300 parts; spar, 150 parts. This is to be levigated and tempered, then passed through a fine sieve; it is then fit for use.

China Glaze.—Stone, 100 parts; borax, 60 parts; whiting, 20 parts; flint, 30 parts; soda crystals, 25 parts. The above to be fritted; then add 5 lbs. of lead per score, and ¼ oz. cobalt blue to whiten it.

Frame Body.—White clay, 16 parts; flint, 4 parts; stone, 1 part. Tempered same as china body.

Frame Glaze.—Stone, 18 parts; borax, 33 parts; flint, 15 parts; whiting, 15 parts; white clay, 10 parts. The above to be mixed and fritted, then add white lead, 9 cwt.

Gold for Gilding.—Gold, 1 dwt.; mercury, ½ dwt.; calcined biscuit, ¼ oz.; flux, as below, 1 dwt. Grind fine in turpentine for use.

Flux for Gold.—Borax, 11 parts; litharge 5½ parts; oxide of silver, 1 part. Fire in a crucible, then grind for use.

Glaze for all Colors.—Borax, 33 lbs.; stone or spar, 18 lbs.; silex, 15 lbs.; whiting, 15 lbs.; china clay, 10 lbs. The above fritted; then add red lead, 12 lbs.; cobalt blue, 1 oz.

ADULTERATION OF VERMILLION.*

PROFESSOR HORSFORD stated that the examinations of numerous specimens of vermillion show that by far the greater portion of the various vermillions in the market are adulterated from one-half to two-thirds. But three specimens were found pure—one from Trieste, one from China, and one from this country. Some samples examined did not contain a particle of mercury, yet strikingly resembled the pure article. The

* American Association for the Advancement of Science.

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principal adulterations used were chromate of lead, red lead, carbonate of magnesia, and sulphate of lime. Professor H. recommended as a test for the purity of vermillion, to apply the agency of heat until all the mercury present became volatilised. The residue consists of impurities.

NOTE ON PHOTOGRAPHY ON GLASS AND ON SOME NEW FACTS.*

BY M. NIEPCE DE SAINT VICTOR.

I HEARD last Monday announced to the Academy a process of acceleration which is the same as that which I deposited, under seal, on the 20th of May last. I should have published it sooner, but that I hoped to show proofs of portraits on a large plate. Those which I have now the honor of presenting, although imperfect, will suffice for proving the rapidity of the operation.

The process consists in mixing with the albumen 2 or 3 grammes of honey to each white of egg, according to size, the same as 30 or 40 centigrammes of iodide of potassium are put in; before beating up the eggs, it is essential that the albumen be completely in the state of froth, so as to have it quite pure.

It has always hitherto been a very difficult operation to spread the layer of albumen equally on the glass plate. Few people apply it properly. A glass rod or a pipette is ordinarily used; or else it is spread by a movement of the hand; but all this requires great practice, whilst, if it be applied by a mechanical method, the thing is rendered uniform and easy: this I hope very soon to be able to demonstrate.

The layer of albumen being dry, the plate is passed into the composition of aceto-nitrate of silver, which should be composed of:—

Nitrate of silver.....	6 grammes.
Combustible acetic acid .	12 ,,
Distilled water.....	60 ,,

The plate should be left immersed in this composition only for ten seconds at most, and afterwards washed with distilled water.

After this operation, the plates are dried in the most complete darkness, in order to operate afterwards by the dry way; but, as the plates are highly sensitive, they must be kept as far as possible simply albuminised.

It is useful, in exposing in the camera obscura, to place a shelf with a white bottom behind the glass plate, and, to make the image appear, it is necessary also to heat with a little gallic acid, in order to expedite the action without hastening this operation too much; for it often happens that the most beautiful negative proofs are those which have remained several hours under the influence of gallic acid, and on which it was thought there would be no image.

The negative proofs are fixed either with bromide of potassium, or with hyposulphite of soda, and, in order to prevent the cliché from scaling (which happens with too thick a layer of albumen, or with the albumen of stale eggs), it is covered with a light layer of gelatine or picture varnish, which gives it more solidity.

Of all the accelerating substances which I have employed, I have found none better than honey (that of Narbonne appeared to me preferable) because it gives greater acceleration without presenting the inconveniences of all the other substances, such as the fluorides, for example, in which I have long since recognised accelerating properties; but their corrosive action (which is manifested by blistering on the albumen) caused me to renounce them for albumen. However, they may be employed without inconvenience by mixing them with honey, and among others, the fluoride of ammonia; and if we use with it the albumen of old eggs, we have by the re-union of these means, a greater acceleration. But I state beforehand that old albumen is more subject to scaling than fresh; it is necessary, in order to avoid this inconvenience, to allow the cliché to dry completely before exposing it to the sun to obtain the positive proof, and, for greater security, to cover it with a varnish.

The mixture of honey with albumen gives to the negative proof a greater softness in the lines, which prevents, consequently, the hardness commonly attributed to this process. We shall have, by this means, demitints and perfectly fused tones, and, by the desiccation of this mixture will be obtained a perfectly homogeneous and very smooth layer, which does not blister even when exposed to the sun, and giving the image of an object lighted by diffused light, in the space of two or three seconds, at most, for a landscape, and from five to eight for a portrait, in operating with a double object-glass (French) for a quarter of the plate; for the great normal plate it takes from forty to fifty seconds and twenty-five to thirty with a German object-glass.

Such are the results obtained by M.M. Vigier and Mestral, who executed the proofs which I have the honor of presenting.

We may also operate more promptly than that by uniting all the natural means

* *Comptes Rendus*, No. 8, Aug. 19, 1850.

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of acceleration to which experience has led me.

1. The thicker the layers of albumen the greater is the acceleration.

2. The older the eggs, the greater the acceleration.

3. The more the aceto-nitrate of silver is used, the greater the acceleration.

Finally, there exists a very great difference in the different natures of albumen, which varies, in my opinion, according to the diet of the fowl. I consider that the albumen of the duck's egg blisters less than that of the fowl's egg. As regards the albumen of the blood, it is very accelerative, but it cannot be employed alone because it does not coagulate with the aceto-nitrate of silver sufficiently to adhere to the glass; it would probably require to be coagulated with nitric acid.

On the washing of the plate also depends part of the acceleration; for if it be not sufficiently washed, a rust-colored layer is formed when the gallic acid is added; if we wash too much part of the acceleration is removed.

I have likewise detailed, in the sealed packet above alluded to, the means of glazing paper with albumen, as well as of preparing a negative paper for operating by the dry way. But various analogous processes having been published by different persons, I speak of them only to prove my priority, as will be ascertained by opening the sealed packet, which contains, moreover, new facts which I think I ought to publish, as being of some interest, and which I here detail.

I have proved that, if albumen be heated in a sand-bath to 113° F., for five or six hours, a very great acceleration is obtained compared with that which has not been so treated. This fact appears to be very analogous to the modifications obtained by M. Chevreul in linseed oil.

I will also mention some facts which appear to me so curious as to warrant it. If we mix a solution of nitrate of silver with a solution of sea-salt or with hydrochlorate of ammonia, chloride of silver is produced. This precipitate, left in the liquor in which it is formed, is colored by exposure to light; if it, then, be exposed to heat, it becomes white.

Every one knows that alcohol coagulates albumen; if iodine be put into the alcohol so as to form a tincture of iodine, it does not coagulate.

If bromine be put into the albumen, the bromine is immediately found enveloped by the albumen without coagulating it, and there are no exhalations of vapors of bromine.

I have the honor of exhibiting to the Academy some proofs of landscapes made by M. Martens, according to my process.

PURIFICATION OF SULPHUROUS RADICAL VINEGAR.*

BY M. CH. MENIÈRE.

CONCENTRATED vinegar, whether crystallisable or not, is too often sold under the name of *radical vinegar;* moreover it is better always to ask for Westendorf's acetic acid, which is colorless, powerfully reddening litmus, which may be kept very well when concentrated, but which alters very easily when more or less diluted; at the ordinary temperature it is always crystallised.

It may be prepared in various ways; it is however preferable to make it with acetate of alumina containing a little water, which prevents the pyro-acetic acid from forming and distilling over. When once distilled it is customary to concentrate the acetic acid by treating with a base, redistilling and treating the residue, which usually contains only acetate, with pure, colorless sulphuric acid; sulphate of soda or potassa is thus obtained. But notwithstanding every possible attention, a portion of the sulphuric acid decomposes, loses its oxygen, and forms sulphurous acid. This odor will be perceived only after some time, and the sides of the bottle will appear covered with a fat oil. This last peculiarity is removed by shaking when the sulphurous odor is developed in a very distinct manner.

It is necessary to have recourse to puce oxide of lead or oxide of manganese, which gives up its oxygen and thus restores it to the state of sulphuric acid. It is then distilled, but at the lowest possible temperature; and we may then be certain of having very pure and concentrated radical vinegar.

Formerly this acid was preserved over sulphate of potassa; this was wrong. There was a serious loss, for a portion of the acid became encased among the crystals of the salt, which, if exposed for some days to the air, diffused a very decided acetic odor.

This method of purification, although not mentioned in any work on chemistry, has probably been already used in some laboratories.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.†

Certain Improvements in Coating or Covering Metals with Tin. ALFRED GUIL-

* *Repertoire de Pharmacie*, Sept. 1850.

†Collected from *The Mechanic's Magazine.*

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LAUME ROSELEUR, of Paris, but now of No. 4, South-street, Finsbury, Middlesex, Chemist. Patent dated March 23, 1850.

THE first part of these improvements is applicable to tinning small articles, such as tacks, hooks-and-eyes, &c., on which a deposit of tin is precipitated by dipping them in a bath composed of water 22 lbs., ammoniacal alum 17½ ozs., and protochloride of tin or other soluble salt of the same base 1 oz., heated to about the boiling point. The alum employed will last for a considerable time, and when the bath is weakened by precipitation of the tin therein contained, the addition of a small quantity of the above salts, or other salts of tin, will restore its action. Cast iron, and other metals in the rough, on immersion in this bath, will be scoured and cleansed, and thereby prepared for either of the following processes.

The second improvement consists of a new mode of coating with tin the surfaces of cast iron and other metals and alloys. The metals to be operated on are to be first cleansed or scoured with azotic, hydrochloric, or other suitable acid to remove the oxide, and then immersed in a bath composed by digesting in 17½ pints of soft water, 10½ ozs. of bitartrate of potassa or soda (tartaric acid, or acidulated tartrite of potassa, or soda cream of tartar,) and then adding an aqueous solution of three-quarters of an ounce of protochloride, or other soluble salt of tin. The metal to be coated is immersed in this solution, and the tin precipitated by the addition of zinc in small pieces. By this method a covering is formed of equal thickness in every part, so that, unlike the operation by immersion in molten tin, in this case the original roughness or inequalities of the metal operated on are not affected. And this circumstance is stated to give additional value to the process, and to render it applicable to a variety of purposes in the arts for which the old process is unsuited.

The patentee describes, lastly, a process of electro-plating with tin. This process of electro-plating has hitherto been applied mainly to depositing the precious metals, and in cases where tin has been experimented on, the chemical substances used, such as cyanide of potassium, &c., were so expensive as to render the process of little commercial value. The bath in which the metal to be coated is immersed consists of 17½ ozs. of water, deprived of its alkaline salts, 11 lbs. of pyrophosphate of potassa or soda, and 4 lbs. 7 ozs. protochloride of melted tin. The positive pole is an anode of tin, not in contact with the metal to be coated. This process is applicable to iron or steel, copper, lead, &c.

Claims.—The coating of metals or alloys of metals by the direct superposition of tin in a suitable stannic solution, and the application of the said process to the scouring of metals, or alloys of metals, intended to receive a future coating.

2. The application of the process of double affinity for the purpose of tinning metals and alloys of metals by means of the simultaneous presence of any metal and zinc, or any other metal analogous thereto, in a solution purposely prepared, as before described.

3. The applications of the voltaic current to the decomposition of a suituble solution of tin for the purpose of coating metals and alloys of metal, as before described.

Improvements in the Manufacture of Candles and Wicks. WILLIAM SYKES, of York Street, Westminster, Tallow-chandler. Patent dated March 23, 1850.

The improvements described and claimed by Mr. Sykes consist—

1. In several peculiar modes of manufacturing dipped candles partly of tallow and partly of stearic acid.

2. In coating externally dipped candles with a compound of bismuth and borax.

3. In impregnating the wicks of dipped candles, plaited or plain, before dipping, with a solution of borax or bismuth, or a compound of bismuth and borax. And

4. An improved apparatus for suspending and cutting wicks.

Improved Machinery and Apparatus adapted for the Manufacture of Sugar. WILLIAM JOSEPH CURTIS, of Port of Spain, in the island of Trinidad, in the West Indies, Civil Engineer. Patent dated March 23, 1850.

Claims.—1. The employment of a hammer or hammers, or stamper or stampers, for the purpose of bruising or crushing canes before submitting them to the rolling mill, whether such crushing apparatus used be in conjunction with or independent of the rolling mill. 2. The employment of a universal joint in cattle sugar mills. And 3. A self-acting feeding apparatus.

2. An arrangement of self-acting apparatus, as described, or any equivalent therefore, for the purpose of regulating the supply of bisulphite of lime and cane-juice.

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3. An arrangement of apparatus as described, for the purpose of separating the molasses from the sugar. 2. An arrangement of apparatus for the purpose of equalizing or maintaining the sugar at a uniform level during the process of filling hogsheads. 3. Ramming the sugar into hogsheads by mechanical means. And 4. An arrangement of apparatus for the purpose of regulating the discharge of sugar from the cylinder.

4. A combination and arrangement of machinery for the manufacture of bisulphate of lime, in which sulphur is maintained in a state of combustion by air forced on it, and the vapor or gas evolved conducted to an agitator similar to that employed in gas works, where it is absorbed by cream of lime. The bisulphite thus formed is drawn off, and a fresh supply of cream of lime introduced.

5. An arrangement of apparatus for the purpose of ladling or transferring the syrup or liquor from one pan to the other.

6. An arrangement of apparatus for the purpose of skimming the pans.

7. An arrangement and combination of apparatus whereby the teach is shielded or protected from injury by the fire while the teach is being struck or discharged.

8. An arrangement of apparatus by which the pitch or inflammable oils are supplied from the reservoir to be burnt under a steam engine, and also the employment of a force or injection pump therein.

9. An arrangement of apparatus by which the pitch or inflammable oils are supplied from a reservoir to be burnt under the sugar pans, and also the employment of a force or injection pump therein.

10. The sole use of sugar pans electro plated with copper, silver, or other suitable metal, or enamelled with a coating similar to that used in ordinary utensils. And

11. The employment of a web or band and hot air, for the purpose of concentrating sugar at a low temperature.

A new and useful process of coating iron and other metals with copper and other metallic substances. EBENEZER G. POMEROY, of Cincinnati, United States of America. Patent dated March 7, 1850.

In order to prepare the iron or other metal for the dipping process, Mr. Pomeroy first cleanses it with dilute sulphuric acid, then dries it over a brisk fire, and envelopes it in a paste or pulp of clay, after which it is a second time dried as before, when it is ready for the finishing operation. In order to carry out this part of the invention, a suitable bath of copper or its alloys is prepared and kept in a state of fluidity. In this the iron is to be immersed for a length of time varying with the size of the article. Thus, sheet iron should be kept in the melted copper only a few second—for this reason, that as soon as "impregnated" (coated) it becomes "hot-short," and will break by its own weight; but if carefully handled when cold, it will be tough, and when rolled will present a bright surface equal in appearance to copper or brass. In other cases the time required for coating will depend on the massiveness of the piece immersed, and on its being raised to a temperature at which the copper is in a condition to commence "impregnation." This may be attained by keeping the melted metal at a heat beyond the bare melting point. In all cases the iron should be immersed only so long as it will bear without becoming "hot-short;" and the toughness of the metal will depend on the amount of "impregnation" during the first dip. The immersion may be repeated till the coating is of sufficient thickness. The patentee observes that the usefulness of clay as a coating depends on the ammonia therein contained, which unites with the residual sulphuric acid of the first process, and neutralises its action on the iron, at the same time preventing oxidation from contact with the atmosphere.

The plates thus "impregnated" are suitable for sheathing ships, roofing, &c.; and iron spikes or bolts for ship-building purposes thus treated, are stated to be, in consequence of their greater strength, preferable to those composed of copper alone; besides which they are not liable to oxidation—the copper acting as a protection against the gallic acid contained in wood.

Claims.—1. The before-described process of coating or "impregnating" iron or other metals of all useful shapes and forms, with copper or any alloy of which copper forms a part—the said process consisting in cleansing the surface of the iron or other metal with sulphuric or other acid, defending the cleansed surface with a coating of clay or other aluminous earth, drying the same, and then dipping the article so coated into melted copper or alloys of that metal.

2. The employment of clay-paste for the purpose of protecting the surface of the metal from oxidation during the process of alloying, or coating the metal plates or pieces of metal, as set forth.

Improvements in the manufacture of rum. JOHN SHEAFE GASKIN, jun., of the Island of Barbadoes, gentleman. (To

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extend to the Colonies only.) Patent dated July 31, 1850.

The patentee observes that the manufacture of rum is at present, and has been hitherto, conducted in a most slovenly manner; no regard being paid either to the quantity of saccharine contained in the "sweet water," skimmings, and molasses used, or to the due proportions of each in mixing;—to the cleanliness of the vats, pipes, and vessels employed—to due ventilation of the building, or to the method of conducting fermentation; in consequence of which circumstances, and the length of time occupied in the last process, generally from ten to fourteen days, owing to an excess of saccharine matter, part of the liquor fermented passes from the vinous to the acetous state, the "dunder," or residue, contains a quantity of saccharine, and the spirit produced is necessarily of inferior quality.

Now, it is proposed to keep all vessels, pipes, &c., clean, by using water and lime to remove and prevent acidity—to limewash the exterior of such vessels and the interior of the building—by due ventilation to keep the building as cool as possible—and to clarify by boiling, the "sweet water," skimming, &c., before mixing. The process of clarification is thus conducted. The "sweet water," &c., is received in suitable iron or copper vessels, and heated to about 212° Fahr., after which the source of heat is removed, the liquor is allowed to cool for about half an hour, when sufficient cream of lime is added to remove all traces of acidity which may be tested by litmus paper. The clear liquor is now to be drawn off, and mixed with molasses, till it acquires a specific gravity of 1050 to 1054 (taking the specific gravity of water to be 1000). When the heat is about 80° Fahr., the process of fermentation may be allowed to commence, and during this process the heat gradually rises to 95°, and even to 96°, but should it rise to 100°, it is evident that the specific gravity of the liquor is rather too great. The process may be considered a "healthy" one, if attenuation takes place at the rate of about 1° during each of the first twelve hours, and to a greater extent afterwards, so as to complete the fermentation in about three days; in which case, if the process be properly conducted, the "dunder" or residue will be of no value; but should the "dunder" still contain any saccharine, it may be again fermented, but on no account mixed with fresh liquor.

As soon as fermentation is completed, the wash is taken to the still—the first receiver of which should contain about 30 gallons of low wine, one eighth of a gallon of common salt to each gallon of wine, and about two gallons of freshly-expressed cane-juice. The second receiver should contain a quantity of fresh spring or rain water equal to the low wine in the first. The first gallon of rum that comes over is to be emptied into the low wines butt. Over each receiver a wicker basket is placed, and filled with vegetable charcoal, through which the rum is allowed to filter; which is considered to be of advantage.

The spirit produced by the above process of manufacturing is stated to be of better quality, and more, in proportion to the quantity of saccharine employed, than that obtained by the methods now ordinarily in use.

The patentee does not confine himself to the precise details above given, so long as the peculiar character of his invention is retained. No claims.

Improvements in separating various matters usually found combined in certain saccharine, saline, and ligneous substances. THOMAS DICKASON ROTCH, of Drumlanford House, Ayr, North Britain, Esq. (A communication.) Patent dated March 26, 1850.

THE first three of the improvements embraced in the present specification have special reference to the centrifugal acting machines which have of late years been so extensively employed for drying purposes, and more recently in the purification of sugar. (See notices of former patents in Mechanics' Magazine; of Seyrig's, which was the first, vol. 39, p. 237—Keeley and Alliott's, vol. 44, p. 420, and Finzel's, vol. 52, p. 319.)

1. Mr. Rotch's first improvement has for its object to prevent or counteract the oscillation of the drum on its axis, when in rapid motion, and consists in the application of a hanging weight suspended from the socket of the vertical shaft—such socket having a hemispherical flange or other contrivance for allowing motion in the nature of a universal joint.

2. Or, the tendency to oscillate, may, it is stated, be got rid of altogether, and the consequent loss of power by friction avoided by steeping the vertical axis within a circle of conical friction rollers bearing up against it.

3. When such machines are employed in the purification of sugar, it is usual to inject a portion of syrup in order to assist the discharging process. Mr. Rotch proposes to use for this purpose syrup, which has been previously supplied from the vacuum pan into large coolers, and consequently in large

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crystals, of the density of 30° to 35° Beaumé, and at a temperature of 120° to 125° Fah. Syrup of this quality is stated to act more effectually than any other.

4. For the purpose of refining sugar, Mr. Rotch suggests the application of woollen, linen, or cotton fabrics, along with sponge, or some other suitable spongy material. The sugar, while in moulds, is to be twice liquored with a solution composed of two quarts of syrup, of the density of 34° Beaumé, and half that quantity of distilled water; a piece of cloth is then to be laid on the top of the mould, and on the cloth a sponge of 1¼ or 2 inches thickness. The cloth and sponge are to be saturated and re-saturated with filtered water, decreasing the quantity at each successive wetting during two days; at the end of which time the sugar will, it is said, be perfectly decolorized, refined, and whitened.

5. Mr. Rotch claims, finally, the "exclusive right and privilege" to the application of centrifugal machines to the treatment of saline substances. The salt to be operated on is placed in the drum, and moistened with pure, fresh, or salt water. The action of the machine expels the water and other impurities, and the salt is left, in a refined and almost dry state, adhering to the sides of the drum.

Certain improvements in the application of orchil to the processes of dyeing and printing in colors, and also an improved apparatus to be employed in the operation of dyeing. JOSEPH THEODORE CLENCHARD, of Paris, manufacturing chemist. Patent dated March 26, 1850.

1. The orchil, or lichen in its natural or imported state, is proposed to be used and applied in combination with alkalies and lime to the direct dyeing of wood and silk, and wool, and silken fabrics. This operation is performed by mixing together 40 to 50 gallons water, and 40 to 50 lbs. quick lime recently slacked; the mixture is allowed to settle, and the clean liquor, after being decanted, is boiled with five to seven ounces good clean soda ash, and 180 to 220 lbs. (in proportion to the depth of color required) orchil, previously ground. The cloth to be operated on may either be boiled now, or after boiling the orchil till a sufficient quantity of coloring is extracted, and the dyewater may be poured off and used as required. On removing the cloth from the dyeing boiler it is to be immersed in a solution composed of dyewater and caustic ammonia, the quantity of which should be equal to about 20 per cent. of the orchil used in making the decoction.

Mr. Clenchard specifies also the application of orchil in its natural or unprepared state in combination with alkalies, and with or without lime to the printing of woollen fabrics. For this purpose, the liquor, composed as above described, is reduced by evaporation to about one-fourth the original quantity, and then applied as customary in printing cloth; but in cases where lime would act injuriously on the material to be printed, it may be dispensed with in making the dye liquor.

3. An improved apparatus for dyeing is next described. This apparatus consists mainly of an octagonal trough with moveable lids. Lengthwise of the trough runs a perforated cylinder supporting a frame-work on which are arranged the pieces of material to be dyed. The cylinder is fitted at one end with a cog-wheel connected with driving machinery, and one arm of the cog-wheel works a force-pump, through which dye is supplied to the cylinder, and by its rotation to the cloth on the frame. For the admission of air the cylinder has an arm attached to it, which at each revolution strikes against and tilts the cover. The dye, as it drips from the cloth, falls into a receiver under the trough, whence it is again raised by a force-pump, and injected into the cylinder.

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III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE PHARMACEUTICAL SOCIETY AND JOURNAL.

At length Mr. Bell has condescended to favor the Memorialists with a reply. He kindly says, in the last number of the Pharmaceutical Journal, that their "proposition demands attentive consideration, and, the premises being proved, no difference of opinion could exist respecting the conclusion." Now, what are the premises? From kindness to Mr. Bell, and to give a sample of his logical acumen, we will take them as he has stated them. Firstly that the Pharmaceutical Society publishing its own transactions, is not a course "more analogous to that usually adopted by learned bodies." How does Mr. Bell attempt to disprove this first premise? By citing the examples of other societies where the object prayed for by the Memorialists is carried out as they desire it should be done in the case of the Pharmaceutical Journal. In every English instance that he adduces, the Transactions are the property of the Society and edited by a paid officer, usually the Secretary. Above all, no editorial or miscellaneous articles are introduced. This includes no puffs on one's medical friends and no insinuations as to where there is a good emporium for drugs, and where prescriptions can be faithfully and accurately prepared.

So much for his disposal of the first premise. As we are not bound to furnish Mr. Bell with spectacles for his mental vision, we shall leave him to reconcile his example and his conclusion, and proceed to the consideration of the second premise, viz., "That it would be more consistent with the dignity and character of the society to publish its own transactions." On this subject he does not venture a word in refutation, but probably considers that his editorship of the Journal confers the greatest possible dignity on the Society, and that the brilliancy of his reputation throws a bright halo around its character. If the members are satisfied with Mr. Bell's vain hallucinations, we have no right to disturb or question the correctness of their judgment.

His third premise is "that it would be conducive to harmony and good feeling among the members that this change should take place." The very article from which we have extracted these statements is a proof that the present state of things is not in harmony with the views of the members. In fact, the numerous signatures to the memorial testify that Mr. Bell's Journal is not conducive to good feeling amongst the members. Therefore, has Mr. Bell disproved the premises or have we proved them? If we have, let there be "no difference of opinion respecting the conclusion." That is, let Mr. Bell retire with Pharmaceutical honors from the editorship of the Journal, or, at least, surrender the monopoly.

Mr. Bell boldly asserts that no single instance can be adduced in 'which he has turned "the press" to his personal advantage.' Does he forget that he has been requested by the Council to remove his name from the title-page of the Journal, and has failed to do so? Is not this evidence that he is sensible of the personal advantage which being puffed as editor of the Pharmaceutical Journal confers?

It is very clever and shrewd to advise the Memorialists to support and improve the Transactions, as at present published, considering that they are his own property, and not the property of the Society, as they should be. He need not be so alarmed at leaving the Transactions in their hands, for it is a well-known fact that many valuable papers are annually lost to the Society because it does not publish its own transactions. The members are not so "green," although they may be monsters in his estimation, as to lend their support to an object of which they disapprove.

We are not surprised at the mortal agony Mr. Bell endures at the prospect of his monopoly being abolished; for his Journal would then pass away like the baseless fabric of a vision, and leave not even a wreck behind. But, luckily, there is one resource left to him to avert this terrible catastrophe: he might give his Journal to the members gratis, as he has already threatened to do. He would still have the pleasure of receiving letters from Shoreditch, and correcting them through the press. He might still attempt to be very facetious, talk about Cæsar's wife, and such funny things. He

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could still indulge his inclinations for outrageous similes, and break Priscian's head without being mulcted in a penalty for the assault. He might still, like the tailors of Tooley Street, fancy that he is the impersonation of the body Pharmaceutical, and pronounce his dignified judgments upon Water Companies, Isinglass frauds, Cholera, Boards of Health, Marylebone Vestry politics; in fact, upon all topics from Baconian philosophy and Butyric acid, to Church mice and poor-house pigeons. Let our friend perpetrate whatever he will, nobody really can be angry with him; for there is something very farcical in beholding a flea inflated with the idea that he has the power of an elephant, and consequently attempting to work out its destiny.

MANUFACTURE OF SUGAR BY DR. SCOFFERN'S PROCESS.

In our last No. we published that part of the correspondence on this process which is hostile to its employment; this month we insert the counter-statements put forth by Dr. Scoffern, and by Dr. Gregory and Professor Brande on his behalf, adding a letter by Mr. R. Warington, published since the appearance of the correspondence in the daily papers.

(COPY.)

From Dr. William Gregory, Professor of Chemistry, University, Edinburgh.

Edinburgh, April 22, 1850.

GENTLEMEN,—I have now continued my trials of the sulphite of lead on dogs and rabbits ever since I wrote last, with certain interruptions, caused by the animals having been repeatedly stolen, so that I had to get new ones. A day or two after I wrote, a dog who was taking it, and had as yet exhibited no bad effects, became ill. I was a little puzzled, but I could not believe that the sulphite was the cause of it. On strict inquiry I found that he had the day before got loose, and entered the laboratory, where he was seen eating something out of a drawer with refuse, dyeing stuffs and liquors. This explained it; he recovered in two days, and again took the sulphite readily, without the slightest bad effect, for some weeks, when he was stolen. Another dog, who had taken it abundantly for about a fortnight, and was perfectly lively and well, was taken away by his owners, in order to be operated on under chloroform; but he got such a dose of it that he died on the spot. All my rabbits throve perfectly on food plastered daily with about three to five grains for each, and they were so well and fat that their appearance evidently tempted a thief, who three times succeeded in carrying them off. All these animals made no difficulty about taking the sulphite, and, as far as I could see, it did them no harm whatever. I think myself, therefore, now justified in declaring my opinion that the sulphite of lead, even when taken daily for weeks in considerable quantity, is perfectly innocuous, and as harmless *as so much chalk would be.* This, indeed, might be predicted from its excessive insolubility and very stable nature, arising from the powerful affinity of sulphurous acid for oxide of lead—this prevents the formation of carbonate (white lead), which is truly the poisonous lead-compound. Even the *sulphate*, which is not by any means so insoluble as the *sulphite*, is innocuous when pure. The sulphite, therefore, is *à fortiori* harmless. I should have no objection personally to use the sugar made by Dr. Scoffern's process, even if some *sulphite* were accidentally mixed with it. Of course, if this did not happen, there could be no pretence for even imaginary danger, when the sulphurous acid has been properly used, to separate any lead that might be present as acetate.

You are at liberty to make what use you please of the whole or any part of this letter.

I remain, &c.,

Professor of Chemistry in the University of Edinburgh,

(Signed) WILLIAM GREGORY.

Messrs. Smith & Charles, London.

(COPY.)

Letter from Professor Brande.

Royal Mint, July 27, 1850.

GENTLEMEN,—In compliance with your request, I have perused the report of Messrs. Thomson, Graham, and Hofmann, and can see nothing in it to shake my confidence in the merits of Dr. Scoffern's process, when conducted with common skill and attention.

Those gentlemen state that they have detected lead in moist sugar from the West Indies, and that they have also found it in treacle prepared by the old and usual process, and they refer its presence in these cases to white paint, and to leaden pipes and cisterns. They did not detect lead in loaf sugar from the same factory in which the treacle did contain lead. But as they appear to have examined the goods of one house only, I think that further inquiry is necessary before any general conclusions can be safely arrived at, respecting the existence or non-existence of traces of lead in the different varieties of sugar in common use.

Of nine samples of loaf sugar, prepared according to Scoffern's patent, they found

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traces of lead in eight—its average quantity in the nine samples amounting to the infinitessimal proportion of 0·05 of a grain in each pound of the sugar.

As respects the treacle resulting from Scoffern's manufacture, it appears that the only fair sample examined, namely, that marked "for consumption," contained 0·595 of a grain of lead in each four pounds, or 0·149 of a grain of lead in each pound of treacle; and that a similar and even larger quantity of lead was found in the treacle resulting from the ordinary manufacture.

Messrs. Thomson, Graham, and Hofmann appear, however, to have examined one sample only of such ordinary treacle, namely, that obtained at the factory where the loaves were derived; but I think that both loaves and treacle coming from other sources should also have been examined, for I believe that, in the low sugars and treacles of commerce, lead and copper are not uncommon ingredients.

An essential point has also been overlooked in Messrs. Thomson, Graham, and Hofman's Report, namely, the *state* in which lead exists in ordinary, as compared with Scoffern's treacle; in the former it is said to be found chiefly as carbonate of lead, which is poisonous; whilst in the latter it is in the state of sulphite, which, according to the experiments of Dr. Gregory is innocuous. These are points which, having important bearings upon the question at issue, require experimental investigation.

I am glad to see that my former opinion respecting the insolubility of sulphite of lead, and the possibility of the separation of all traces of lead from syrup by means of sulphurous acid, are admitted by Messrs. Thomson, Graham, and Hofmann, because these, in conjunction with the inertness of sulphite of lead, are the points on which the safety of Scoffern's process depends.

That the objects attained by Scoffern's process are equally attainable by other perfectly unobjectionable methods, I cannot admit; nor do I think that this ingenious and effective invention should be deprecated merely because it involves the use of a salt of lead; leaden pipes, pumps, and cisterns, and all kinds of copper vessels might upon similar grounds be interdicted. In respect to the Medical Report of Drs. Pereira, Taylor, and Carpenter, it seems to me that those gentlemen found their inferences as to the mischievous character of Scoffern's process upon two data, neither of which is equitable; first, they adopt the quantity of lead contained in a sample of treacle avowedly impure, and delivered as such from the sugar-house, as the basis of their calculations; and, secondly, they assume that the sulphite is a poisonous *salt* of lead, and that it cannot be excluded from the sugar.

I must now conclude by repeating my conviction that, with common care and attention, sugar, in a wholesale way, may be made free from lead by Scoffern's process; and that the presence of traces of sulphite of lead in his treacle is of less consequence than the presence of traces of carbonate of lead, which I believe to be very common in all treacle.

If, on the contrary, more extended experience in Scoffern's process should prove that, with ordinary precaution, sugar free from lead cannot be produced by it on the large scale, and the sulphite of lead is a poisonous salt, then I think that common sense would suggest its abandonment.

I remain, Gentlemen, faithfully yours,

(Signed) WILLIAM THOMAS BRANDE.

Messrs. Coote, Brown, & Co.,
King's Arms Yard.

TO THE RIGHT HON. SIR CHARLES WOOD, BART., CHANCELLOR OF THE EXCHEQUER.

SIR—On my return to England yeterday, the report of Drs. Hofmann, Thomson, and Professor Graham, together with the reply of Messrs. Coote, Browne, and Co., and the letter of Mr. Brande to those gentlemen, were put into my hands.

The statements contained in these memorials are so pertinent, that my own comments will be but few.

Although it is perfectly true, as your investigators allege, that my process, properly conducted, is capable of absolutely removing lead which may exist dissolved in sugar solutions, there exists a still more powerful guarantee of its safety in the fact that it unerringly converts all soluble lead present into an insoluble, and, therefore, perfectly innocuous condition; *hence the ultimate issue is a physiological one, to be decided by experiments on living animals.*

Dr. Gregory, Professor of Chemistry in the University of Edinburgh, has, after prolonged experiments on animals, pronounced the sulphite of lead *to be as harmless as chalk;* and I myself, and some friends conversant with the fact, are ready to demonstrate the harmlessness of sulphite of lead by ingesting for any time so much of this substance as an equal number of other individuals will ingest chalk. *I am ready, moreover, to expose my own children to the same test.*

In Spain, the British Vice-Consul of Motril has for a considerable time used sugar in his family made by my process *without the second filtration*, and hence,

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which contained sulphite of lead in the maximum proportion which could have been present under the grossest possible mismanagement.

This was done purposely, and after the receipt of Dr. Gregory's communication.

The physiological fact which doubly guarantees the safety of my process, *is wholly disregarded by your investigators*, who have committed the grave error of converting all the lead present, in whatever condition, into the sulphate, and estimating it as such, although Dr. Taylor, directly or indirectly, the only writer on poisons amongst your investigators, quotes experiments of Orfila to prove that sulphate of lead, being insoluble, is not poisonous, and Dr. Gregory has proved that the sulphite is even more insoluble than the sulphate.

Your investigators limit their remarks to the refinery operations, as regards the case of cane juice, the only experimental testimony brought before your consideration appears to be that of Dr. Shier. With respect to this gentleman's report, I will solicit your attention to the fact that it admits the complete separation of lead as indicated by the test, but subsequently propounds the discovery of a very minute quantity of lead (form not mentioned) in the results. Now, subsequently to testing, and before the elimination of results, the sugar solution, *to Dr. Shier's knowledge, came very largely in contact with vessels painted with red lead;* hence the discovery of a very minute quantity of lead may, with the highest degree of probability, be attributed to this source.

Your investigators disapprove of the use of a poison in the preparation of an article of food when it can be avoided, a proposition which, if rigidly accepted, would not admit of the use of lime in the ordinary process of sugar manufacture.

Perhaps it may not be deemed irrelevant for me to remark that the result of my operations on Spanish cane-juice on the large scale has been the production of upwards of 20 per cent. of sugar in lieu of the 6 or 7 per cent. as extracted by the ordinary process of manufacture, and this without any difficulty whatever. I am ready to furnish samples of this sugar, or to exhibit the workings themselves to any properly-qualified delegate.

I would, therefore, ask whether a process yielding an increase of 200 per cent. should be impeded in deference to anything short of the most precise testimony as to the danger which it involves.

I will now draw your attention to the following facts:—

1. That whilst all lead which may be present in sugars prepared by the ordinary process is necessarily soluble, or in the form of carbonate, in both cases poisonous, all lead present in sugars made by my process, and as the result of that process is necessarily insoluble, and therefore innocuous.

2. That if small traces of lead in any form are to be regarded as dangerous when present in sugar or treacle, there is not a refiner in the United Kingdom whose goods will not be subject to condemnation.

Finally, I solicit another and more extensive chemical examination not only of my sugars, but of sugars from various refineries to be indicated by me, with myself, or one or more chemists deputed by me, present to check results; these results to be published, as well as the form of analysis which led to them, care being taken to indicate the precise state in which lead, if any, was found.

I solicit a physiological investigation of the effects of sulphite of lead on the human economy, and reiterate my offer of myself, my children, and many scientific friends to take any dose of sulphite of lead, and for any time that any equal number of individuals shall take equal doses of chalk.

I have the honor to be, Sir,

Your most obedient humble servant,

(Signed) JOHN SCOFFERN.

(MEMORANDUM.)

A note was this day received by Dr. Scoffern from Mr. Arbuthnot, on behalf of the Chancellor of the Exchequer, dated August 9, 1850, stating that it was the intention of Her Majesty's Government to lay on the table of the House of Commons all the papers and correspondence connected with the investigation into Dr. Scoffern's process, together with letters received from Dr. Scoffern and his solicitor.

This note has unfortunately been mislaid, but the above memorandum contains the substance of it.

London, August 10, 1850.

TO THE RIGHT HON. SIR C. WOOD, BART., CHANCELLOR OF THE EXCHEQUER.

74, Old Broad Street, London,

August 10, 1850.

SIR—I have at this moment received your communication, through Mr. Arbuthnot, of the 9th inst., stating that it is your intention to lay the whole of the papers relative to my patent before the House of Commons.

I now take the liberty of reminding you that the letters of Professor Brande, of Messrs. Coote, Browne, and Co., and of myself, have fully established the fact that the reports of the chemical and medical commissioners (appointed by yourself without any communication with me, or afford-

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ing me the slightest opportunity of guarding them against any error which their mode of procedure might involve) are erroneous in several respects.

1. They have chosen as their standard of comparison the sugars and treacle only of one manufacturer by the old process, selected by themselves.

2. They have chosen, on my part, a sample of sugar and treacle for comparison which was put before them as the result of first and imperfect machinery, and which they knew had been corrected before the sample was furnished.

3. They had not distinguished between lead in a noxious and lead in an innocent form.

4. They have not stated their process of analysis with such precision as to enable any chemist to judge whether their results are entitled to confidence.

5. Finally, they have not made any physiological experiments as to the nature of sulphite of lead, although the certificate of Dr. Gregory as to the innocuity of that substance had been furnished to them.

I protest, therefore against such Report being issued; the effect of which may be to prejudice any process which, if thoroughly examined, will not only be found perfectly safe, but more safe than the old process when conducted by the ordinary means of leaden tanks and pipes.

I solicit any fair and extended investigation; but emphatically protest against any interference with my process on the strength of the irregular, unchemical and imperfect Report now before you.

I have the honor to be, Sir,
Your obedient servant,
JOHN SCOFFERN.

September 26, 1850.

GENTLEMEN,—I have attentively perused the printed report made by the professors of chymistry and medical jurists on the subject of Dr. Scoffern's patent for refining sugar, and beg to hand you the following observations thereon. It appears that the patent process, as directed in the specification by Dr. Scoffern, was followed out three several times by Professors Thomson, Graham, and Hofmann without any trace of lead being found in the results, such results having been submitted to rigid analysis. The process is therefore quite unobjectionable in every respect on this evidence.

Now it appears that the results of the several examinations, as detailed in the report, are all obtained from four pounds weight of the sample operated on, and in terms of the equivalent of lead in the form of sulphate of lead. In what state of combination the lead really existed in the samples is not specified, or whether it were in a poisonous or innocuous form. This was a most important point to have determined, as there is every reason to believe that in the results of the ordinary process of refining sugar the lead exists in the poisonous form of carbonate and oxide; while in the new process, if it exists at all (as far as the operations of the process are involved), it would be in the form of sulphite, mechanically suspended: and this I consider could only arise from imperfection in the filtration. This sulphite appears to be perfectly innocuous and insoluble, and the facts mentioned in your letter of the 17th inst. afford indisputable evidence on this point, irrespective of the results of Dr. Gregory's experiments*:—'For one year and ten months the members of a firm, consisting of four gentlemen, employing Dr. Scoffern's process, have used exclusively the sugar and treacle so made in their families; that their operatives, men and boys, not only are permitted to eat an unlimited quantity on the premises, but each individual is allowed one pound weight per week of the bastards for his own consumption; and that during the whole of this period no case of indisposition has occurred amongst the consumers of any of these products, although the Asiatic cholera prevailed in the neighbourhood for several months.'

The mode of analysis adopted by Professors Thomson, Graham, and Hofmann for the estimation of the lead, which they state to be very easy and complete, and the sufficiency of which was tested, appears to me, judging from the published results, to be very unsatisfactory. For instance, we find it stated that one and the same quantity of treacle, made by the old process, yielded in one experiment 0·62, and in a second 1·21, or very nearly double the quantity. Surely a method of analysis that will yield so widely differing results from the same sample cannot be received as complete or satisfactory.

The specimen first examined is an authenticated sample of West India sugar, which yielded lead equivalent to 0·39 grains of sulphate from the four pounds. Loaf sugar, the produce of the old refining operations, is next examined; but only one sample of bastards, or of treacle, is mentioned as having been submitted to experiment, and all these samples the produce of one sugar-house. The result on the loaves is left

* Letter from Messrs. Coode Browne, and Co., dated September 7, 1850.

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doubtful, on the ground that not so much lead as is equivalent to 0·05 of sulphate of lead could be present—so it is stated. The bastards yielded 0·25, and the treacle 1·21; these are the maximum results.

The products of the process of which the patent forms a part, as obtained from parties who had been working only a short period, are then experimented on. Now it must be obvious that the first introduction of a new process, however perfect, and however suitable to the large scale, will at first, to a certain extent, be attended with difficulties in its practical working out. The evidence of Mr. Goodhart's letter proves this to be the case in the present instance. He says, 'We have to remark that, owing to the defective nature of the filtering apparatus, after the gasing operation, the liquor was at times turbid (though we have since remedied that defect, and obtained constantly a brilliant liquor); but it is probable that in some of the sugars, as per samples herewith sent, a portion of sulphites may be detected, but we believe no other traces of lead, further than may have been caused by contact with leaden pipes and cisterns, which we, in common with most other sugar-refiners, make use of, as also white lead, in painting the iron moulds.'

No examination appears to have been made of the syrups obtained by the new process before they were brought in contact with the leaden pipes, cisterns, and painted moulds alluded to in this letter; and all the lead found by Professors Thomson, Graham, and Hofmann in these samples may really have arisen from this source; and if so, a great injustice may have been done by the report from want of proper circumspection.

In regarding, therefore, the results obtained by Professors Thomson, Graham, and Hofmann from the samples procured under these circumstances, it seems to me that a much nearer approach to accuracy will be attained by taking the minimum weights as evidence of the working out of Dr. Scoffern's process, which process they themselves report as perfect. The results, then, will stand thus:—In loaves, no lead: bastards, 0·48; in the treacle, 0·87; or, by comparison—

	Old process.	New process.
Loaves	0·05	None
Bastards	0·25	0·48
Treacle	1·21	0·87

The report of the medical jurists, Drs. Pereira, A. Taylor, and Carpenter, is of no value whatever, inasmuch as it is based on fallacious grounds; for they state, 'Our investigation practically resolves itself into the inquiry whether 1·261 grains of metallic lead contained in a salt of lead, capable of becoming dissolved by the juices of the alimentary canal, swallowed weekly for probably many months, are capable of producing serious injury to health.'

Now, there is no evidence whatever in the report to show that the lead stated to be contained in the samples examined was in such a state as that required by these gentlemen, and on which supposition their report is entirely founded; nay, worse, they adopt the very extreme result obtained from a sample of treacle which was stated in writing by the manufacturer to be objectionable from a defect in the working of the filtering apparatus, and on this assumption they call in question the chymical accuracy of the patent process.

In conclusion, I beg to state that I can see no reasonable grounds why the patent process should not be as perfect upon large as upon small quantities; the lead employed at present having been rendered insoluble by the sulphurous acid, the next operation is the mechanical one of removing the innocuous compound from the syrup—an operation in which there can be but little difficulty with a proper filtering material.

The concluding paragraph of the report is at variance with what has been repeatedly published and well known before the introduction of Dr. Scoffern's process—namely, that the acetates of lead were the best defecators of sugar solutions. The problem was how to use them safely. I consider that this problem has been fully and satisfactorily solved, and the report itself tends to confirm me in that opinion.

I remain yours respectfully,

ROBERT WARINGTON.

Messrs. Coode, Browne, and Co.

It appears to us that although the chemical report of Professors Thomson, Graham and Hofmann is far from satisfactory, those interested in upholding Dr. Scoffern's process have by no means fully proved their case. It has not been proved either that the sulphite of lead is poisonous or that it is innocuous, and until proof has been given in one way or the other, we are justified in withholding our sanction to the use of a process which leaves any quantity, however small, of a salt of lead in sugar and treacle. The fact that Dr. Scoffern and his family, and other persons (although interested parties) have for a considerable period partaken regularly, and without experiencing any ill

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effects, of the sugar and treacle produced by Dr. S.'s process, is entitled to great consideration.

The letter of Mr. Warington merits attention, and we are glad to have the opportunity of laying it before our readers with the completion of the former correspondence.

On the whole, we consider that further and more ample investigation is imperatively necessary, prior to the condemnation or sanction of the process.

We concur in the opinion that the same objects may be attained as well, or nearly as well, by other means; but the question for consideration is not whether Dr. Scoffern's process is the best or the only one for effecting the purpose to which it has been applied, but whether it is or is not attended with danger to human life, and this question, we think, still remains to be solved.

POISONOUS EFFECTS OF SULPHATE OF LEAD.*

BY M. C. FLANDIN.

Some years ago M. de Ruolz proposed to replace the carbonate of lead by sulphate of lead. It was thought that this latter salt, being insoluble and more stable than the carbonate, would be less easily reduced or decomposed by the powers of the organism. This presumption was strengthened by the fact that a workman engaged in the manufacture of sulphate of lead, accidentally swallowed more than fifteen grains of the salt without experiencing any ill effects. M. de Ruolz, in communicating to me this result and his hopes, requested that I would try the action of sulphate of lead on some animals. In order to assume, as far as possible, the conditions to which the workman engaged in the white lead works are exposed, it appeared to me desirable to apply the metallic salts by means of friction over the skin.

I had the hair shaved from the skin of a dog, and about seventy grains of an ointment, composed of equal parts of lard and sulphate of lead, rubbed in every day. After the tenth day the animal was observed to be affected as if under the influence of the commencements of intoxication. He became constipated, rejected his food, and was evidently ill. He rapidly got worse, and died on the twenty-second day, less than two ounces of sulphate of lead having been used in the frictions. Analysis indicated the presence of the poisonous metal in the organs, and especially in the liver. Soon after this experiment, the foreman to M. de Ruolz's manufactory was attacked with lead colic, of which he died. M. de Ruolz was the first to renounce his faith in the harmlessness of sulphate of lead, and to relinquish its manufacture.

* *Comptes Rendus and Pharmaceutical Journal.*

OBSERVATIONS ON THE SULPHURETS OF ARSENIC, CONSIDERED AS DEPILATORIES.*

BY M. FELIX BOUDET.

The numerous cases of poisoning of which arsenic has been the instrument caused the legislature, in 1845, to place restrictions on the sale of poisons in general, and in 1846, a royal ordinance was issued which interdicted under severe penalties:—

1st. The sale of arsenic and its compounds for other than medical purposes, unless combined with other substances.

2nd. The sale and use of arsenic and its compounds for steeping grain, embalming bodies, and destroying insects.

In consequence of these wise measures the retail trade in arsenious acid has been suppressed, and this terrible poison, which not long since was in the hands of all our farmers as an indispensable agent in the steeping of grain, has entirely disappeared from the agricultural districts.

The removal from criminals of this powerful engine is a great benefit, but there are yet other arsenical products employed of almost equal effect as arsenious acid, I mean the sulphurets of arsenic.

One of these, under the name of *orpin*, is used by leather dressers, in the preparation of sheep skins. This is not orpiment as its name would appear to indicate, but an artificial or false realgar, which according to M. Guibourt, contains one and a-half per cent. of arsenious acid, and constitutes a very active poison.

The other, under the name of *yellow sulphuret of arsenic* enters into the composition of indigo-baths, and forms the base of depilatory powders and pastes. Yellow arsenic or false orpiment is prepared in Germany by the sublimation of arsenious acid with sulphur. Being formed of 94 per cent. of arsenious acid and of only 6 per

* *Journal de Pharmacie et de Chimie.*

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cent. of sulphuret of arsenic, it is almost as poisonous as arsenious acid itself. The annual importation of these two sulphurets into France, amounts to more than 300,000 kilogrammes.

Orpin has only been used in leather-dressing during the last twenty years; it detaches the wool from the skin without the necessity of steeping it in a lime bath, according to the old process, and is on this account of unquestionable service.

Having had occasion to pay particular attention to the application of chemistry to tanning in advantageously replacing lime by soda in this process, I have been thus led to study the use of orpin in leather-dressing. I have long been convinced that this question involved a subject of great importance in a sanitary point of view.

The poisonous qualities of sulphuret of arsenic, the ease with which consumers obtain it from the retail dealers, the large quantity of this substance which is daily, in Paris, poured into the river Bièvre after having been used in the leather manufactories, were circumstances calculated to excite serious anxiety. And, in fact, M. Bussy has informed me, that in 1846, whilst making some experiments relating to a report required of him by the Council of Health, he with Marsh's apparatus found arsenical stains not only in mud from the bed of the Bièvre, but even in some mud taken from the bottom of the Seine, under the bridge of Austerlitz. The discovery of some depilatory which should be equally useful, and which should not be so dangerous, was indeed a desirable object.

Depilatory processes had not at that time been the subject of any scientific examination, and if, according to Berzelius, we ought to attribute the effects of the mixture of lime and sulphuret of arsenic to the solubility of hair in caustic alkali, this question, presented to us by that illustrious chemist in the form of a doubt, by no means accounts for the preference shown to the mixture over lime alone.

I had then to seek for a true depilatory agent, and to find out whether arsenic was of any real use in the phenomenon of depilation.

For the purpose of solving this problem, I separately examined the properties of each of the compounds which might exist or be produced by the mixture of sulphuret of arsenic, lime, and water, which is applied to the flesh side of sheep skins to remove the wool, and I thus found that neither the lime, the arsenious acid, nor the sulphuret of arsenic had much influence in the result, but that it should be attributed to the formation of sulphuret of calcium by the reaction of the lime on the sulphuret of arsenic.

I have proved that sulphuret of calcium acts energetically as a depilatory when employed alone, and that this quality is shared by the monosulphurets of sodium, barium and strontium.

These observations naturally gave me the idea of replacing the sulphuret of arsenic by sulphuret of sodium, or hydrosulphate of soda, of which I had already introduced the use in therapeutics, particularly in the fabrication of mineral waters and sulphur baths.

This new agent succeeded even beyond my hopes, and gave more rapid results than orpin, so that only a few hours after its application to a sheep skin, I could without difficulty remove the wool in one piece.

Nothing could be easier than to substitute sulphuret of sodium for sulphuret of arsenic in dressing the skins. The expense would not be greater, and the advantages of this substitution would be considerable, whether we regard the health of the workmen who prepare, pulverise, and apply the orpin, or the security of the public which is concerned in prohibiting the use of poisonous substances.

Having thus succeeded in my first endeavor, I was encouraged to pay attention to the depilatory pastes and powders which are much used in the East, from whence our knowledge of them has come, and are not unfrequently employed in France.

The rusma of the Turks, the depilatories of Plenck, Colley, and Delcroix, are all mixtures in various proportions of lime and sulphuret of arsenic, to which some add gum, others starch, and sometimes a little caustic alkali, and which are applied to the skin after being mixed into a paste with a little water.

These various methods do not always succeed, and their application is subject to great inconveniences, as M. Guibourt has already observed.

In fact, as yellow sulphuret of arsenic is, as we have shown above, almost pure arsenious acid, so powerful an agent cannot be applied to an extensive surface of the skin without danger. The preparation, the manipulation of these depilatory powders, most frequently performed by persons who are quite without medical or pharmaceutical knowledge, must be attended with great dangers which should be examined into and the cause suppressed.

My investigations have proved that the arsenious acid is without effect in these

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depilatories as in the processes of dressing skins, and that depilation can be obtained with more rapidity and certainty, by means of a paste of sulphuret of sodium and lime, than with any of the arsenical compounds hitherto known.

I will now give the formula which I propose :—

R	Grams.
Sulphuret of sodium or hydro-sulphate of soda in crystals..	3
Quick lime, in powder.....	10
Starch.....	10

Mix. This powder, mixed with a little water and applied to the skin, has so rapid a depilatory action, that if removed with a wooden knife in the course of one or two minutes, the surface of the skin will be found entirely bare. By this process depilation becomes so simple, rapid, and harmless an operation, that I am convinced it will soon be substituted in many cases, for shaving. Hitherto the tediousness, uncertainty, and, above all, the poisonous nature of depilatories, have greatly limited their use; but it is easy to foresee the numerous applications of these agents when rendered easy and devoid of danger. Besides the advantage which it presents in the removal of superfluous hair, may it not be of great service to physicians and surgeons in connection with the application of blisters and epithems, and in the practice of certain operations.

It may be applied to the smoothest and most delicate parts, over the smallest or most extensive surfaces, and the hair will not reappear for several days.

I shall not proceed farther with the applications; they will present themselves to practitioners; but will conclude by stating that the results of my observations have led to the three following inferences :—

1st. That an inoffensive agent, sulphuret of sodium, may, with advantage, supersede the sulphurets of arsenic in most cases.

2nd. That for the interests of the public security and health the sale and use of the sulphurets of arsenic should be prevented, at least as far as concerns skin dressing and depilatory preparations, and that they may, doubtless, be soon forbidden in indigo works, in which, as in skin dressing, they most probably act merely by the alkaline sulphurets which they produce.

3rd. That the depilatory powder of sulphuret of sodium may advantageously replace all arsenical depilatories, and, in consequence of its perfect harmlessness, may have far more numerous applications than these preparations.

ON THE YELLOW CINCHONA OF COMMERCE.*

BY M. E. FONTAINE, PHARMACEUTIST AT SEVRES.

I THINK it right to call the attention of pharmaceutists to a fraud, which, although pointed on several times, is nevertheless now carried on to an extent which may, without exaggeration, be said to render it absolutely impossible to procure pure yellow cinchona. In support of this assertion, I shall here give a summary of the result of the examination of two specimens of this valuable therapeutic agent, procured from two different sources.

1st observation—The cinchona which was the subject of this examination had all the physical characters of a good quality of bark. Experience having taught me how little importance should be attached to the external appearance, I wished to ascertain whether chemical analysis would confirm the good opinion which might be, *a priori*, formed as to its value. For this purpose, I detached about 15 grammes in fragments from different parts of the bark; I reduced them to a coarse powder, poured over it about 50 grammes of distilled water, and I immediately found a distinct acid reaction with test paper. This indicated that I had a cinchona which had been partly, if not entirely, exhausted by an acid. It is at all times right to observe that the contact of water with the cinchona should not be too much prolonged, for then the acid, which is easily dissolved, will be neutralised by the quinine or cinchonine, of which the barks are never quite deprived. In the filtered liquor, nitrate of silver formed a slight white precipitate, insoluble in nitric acid, soluble in ammonia; thus proving the presence of hydrochloric acid.

I then took 125 grammes of the same bark, and treated them by the processes employed for the extraction of sulphate of quinine, taking care several times to use alcohol, so strong as to be certain of dissolving all the alkaloïds, quinine, and cinchonine, which may be contained in the calcareous precipitate. I distilled the alcoholic liquor in the sand-bath, and I obtained, instead of an amorphous resinous mass, crystals which presented all the characters of cinchonine. I poured sulphuric acid over these crystals, so as to obtain a feeble acid reaction; I boiled it, after the addition of animal charcoal; I filtered the boiling liquid, in the hope of at least obtaining

* *Repertoire de Pharmacie*, August, 1850.

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some crystals of sulphate of quinine. I concentrated the liquor several times, and obtained sulphate of cinchonine, but not a trace of quinine.

2nd observation.—The cinchona submitted to this second examination likewise presented every external character of a bark of good quality. I first proved the presence of hydrochloric acid. Being curious to discover how far these cheats had carried their criminal industry, and desirous to see how rich this second bark was in alkaloïds, I took 350 grammes of this cinchona, and treated them in the manner mentioned in the first analysis. I this time obtained 3 grammes 50 centigrammes of sulphate of quinine—that is to say, less than half the quantity which would be procured from an unexhausted bark.

From the preceding, and from other experiments of my own, I conclude that there is no longer to be found in commerce any cinchona which has not been subjected, before it comes into the hands of the pharmaceutist, to an operation tending to deprive it of the quinine contained in it, and which constitutes its value. It even appears that this system, which must give enormous profits to those who employ it, is chiefly carried on in Paris; and the cinchonas, thus deprived of the principles which render them valuable, are sent to Havre, then returned from that city to Paris, and afterwards sold to the druggists as bark arriving from America.

It is to be hoped that the authorities will discover the authors of this odious trade, and that efficient punishments will be inflicted on those who have recourse to such criminal means of attaining wealth. Whilst waiting for this result, so anxiously desired by all men who are sincerely devoted to the interests of humanity, I cannot too earnestly entreat my readers not to accept any yellow cinchona, without being certain of its richness in alkaloïds.

I am well aware that yellow cinchona has not, since the valuable discoveries of Pelletier and Caventou, been much used in therapeutics; nevertheless, it is a well-known fact, among practitioners, physicians, and others whose practice lies in localities where fevers are more or less endemic, that there are cases in which these complaints rebel against sulphate of quinine, and in which, on the contrary, a marked advantage is derived from the use of the powder of the yellow cinchona. It is then highly requisite to have at hand a cinchona which has not been deprived of its active principles.

ON HYDRO-FERROCYANIDE OF POTASSIUM AND UREA.*

BY M. BAUD.

"On the 5th of last March, I presented to the *Académie de Médecine* a work on intermittent fevers, and on their treatment by *hydro-ferrocyanide of potassium and urea*, a new salt, the composition of which I had at first traced according to the theoretical ideas which have since received the practical sanction of numerous experiments, pursued in different countries during three consecutive years, not only by myself, but likewise by many distinguished men.

"These experiments were not pursued, and less in Paris than elsewhere, during a season of intermittent fevers, but the *bureau central* each day sent to the hospitals numerous colonists driven from Africa by the fevers, whose obstinacy was so great as to resist sulphate of quinine. Thirty cases were thus in a short time subjected to the new medicament. In all these cases proof had been obtained previously that neither change of air, patience, nor a perturbatory course of medicine such as purgatives and emetics, would prevent a return of the attacks; all, or nearly all, had constitutional signs of a serious marshy cachexia, an earthy tint of the integuments, great debility, *bruits de soufflet* in the heart and larger vessels, considerable engorgement of the spleen and liver, serous infiltration, dropsy, etc. In the greater number of cases, sulphate of quinine, in some, arsenical preparations, had been tried for a long time, either without preventing incessant relapses, or even lessening the frequency of the attacks. Now, notwithstanding the obstinacy, the age, and the hold on the constitution of all these cases, the results of the new medicine were as follows:—26 complete cures, 2 doubtful cases, 3 rebellious cases. The 160 observations related in my memoir, which were drawn not only from my own practice, but from that of numerous other individuals perfectly without interested views on the subject, have thus ample justification.

"My deputies, who performed the careful experiments required by such a subject, by thus multiplying facts and choosing the most obstinate cases, wished also, for the advantage of science and medical practice, to announce to the medical world, under the guarantee of the scientific supremacy of the Academy, that sulphate of quinine has now a rival which is, if not of superior, at any rate, of equal, efficacy, and the use of which is without the numerous and serious incon-

* *Union Médicale.*

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veniences attached to the use of the salt of cinchona. A report was drawn up according to this opinion, but on the very day on which it was to have been publicly read before the Academy, one of the commissioners suggested that a more prolonged, and in some sort, generalised, trial was necessary wherever agueish fevers prevailed. He was of opinion that, in a question of such high interest, years of trial and a vast jury composed of all practioners who in diverse countries have to struggle against agueish influences, should alone be sufficient authority to cause a definitive judgment between sulphate of quinine and its new rival. This opinion prevailed."

Our author rejoices at this, and properly. We earnestly hope, both for his sake and humanity, that his success may be in accordance with his expectations.

ACTION AND PHYSIOLOGICAL EFFECTS OF HYDRIODIC ETHER.*

BY M. HUÉTTE.

BEFORE describing the action of hydriodic ether on the animal economy, we will explain the process of inhalation which we have followed during our experiments so as to render it innocuous, at the same time ensuring the rapid absorption of this medicament.

A small stoppered flask may be used, three or four centimeters high, into which one or two grammes of ether are introduced with a graduated pipette; this ether is then covered with a layer of about two or three millimeters of water which will form a moveable moderator, intended to moderate the evaporation; the flask is then placed to the nostril, so as to remove by inspiration the air above the liquid. The etherised vapors reach the lungs properly mixed with the external air. To accelerate the evaporation it will suffice to lessen the intervening liquid by slightly inclining the phial; all the water will then unite in one large drop and will leave the greater portion of the ether uncovered. The warmth of the hand may be used for the same purpose. Fifteen or twenty of such inhalations will impregnate the system with iodine. Absorption is so rapid that after the lapse of a quarter of an hour reagents will indicate iodine in the urine. Besides this substance being quickly eliminated we have several times proved its presence from fifty to sixty hours after the inhalation. I will hereafter mention, when treating of the therapeutic applications of hydriodic ether, the conditions which it will be necessary to fulfil when the inhalations are prescribed with a curative object.

I will now describe the effects which it produces. After some inspirations a sensation of calmness and contentment announces that hydriodic ether acts at first conformably to the sedative properties of the other ethers employed in medicine. The respiratory movements are likewise performed with an ease and an amplitude which are beneficial to the hœmatosis; but the antispasmodic action of the etherised vapor which is favorable to the administration of the remedy is soon succeeded by the ulterior action of the iodine absorbed. The increase of vigor is not limited to the thoracic muscles, but is extended over the whole muscular system. The appetite becomes better, the secretions more active, the genital organs are excited, the pulse becomes full, and the vivacity of the sensations, and the activity of the intellect prove that the impulse given to the other organs extends to the brain. Such are the effects, that four daily inhalations, each of ten minutes, have produced on us at the end of some days. As for accidents, we have only found a little coryza, and more frequently, if the vapor were not too concentrated, a momentary sensation of pressure on the temples.

The whole of these phenomena shew that hydriodic ether participates in the highest degree in the properties common to the other preparations of iodine. If we now consider that it has a peculiar mode of administration, that by diminishing the evaporation its effects can be moderated at pleasure, we cannot refuse to this compound a certain superiority in most cases over the other medicinal preparations of iodine.

The inhalation of iodine, then, enables us to reduce the dose to the minutest fractions, and to have it absorbed by a more extended surface, more simultaneously accessible in all its parts, and better fitted for the absorption of the minutest medicinal atoms than the digestive organs are. As each dose only remains in contact with the lungs during one inspiration, the treatment may be prolonged by managing the susceptibility of the organs. Besides it is to be observed that the substances thus absorbed are not expelled until they have passed through the entire circulation, and act either chemically or dynamically on the whole system.

The general advantages of respiratory instead of digestive means, as regards ab-

* *Gazette Médicale.*

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sorption, are manifest; let us then pass to the examination of the special pathological cases in which the inhalation of hydriodic ether gives indications drawn at once from the chemical and physical properties of that body.

We know that in certain cases of poisoning, metallic iodides are prescribed as antidotes, because they decompose amongst the tissues, and they eliminate the accidental products of the poisonous matter; hydriodic ether will be especially advantageous where the poisonous substance shall have irritated the stomach or impaired the gasto-intestinal organs of absorption; it will be equally useful in poisonings with morphine, strychnia, and the other vegetable alkalis, when vomiting opposes the introduction of iodine by the digestive organs.

Glucosuria, so often united to tuberculisation of the lungs, has been, in some instances, successfully treated by preparations of iodine; here the use of hydriodic ether will be justified at once by the general affection and by the local change. I have proved the efficacy of this ether in several chronic affections of the lungs.

Induction leads us directly to the employment of hydriodic ether in the numerous cases where hereditary taint, as well as the acquired constitution, makes us fear that latent tuberculisation, the ravages of which are often manifested with a rapidity which destroys all hope of cure.

The general action of the medicine on the diathesis, the local and detersive action which dissipates the first manifestations of the evil, finally its evident efficacy in scrofulous diseases which have so great an analogy with tuberculous affection establish a favorable presumption in support of which we shall cite more than one authority.

It is well known that Laënnec, Scudamore, Berton, Murray, &c., extolling the inhalation of iodine for phthisis, made several attempts to take this substance directly into the air passages of the lungs. They had then no idea of a new method of general treatment: these medicines were merely inspired from a desire to place the resolutive *par excellence*, iodine, in contact with the pulmonary parenchyma, to produce the salutary effects which the topical application of this medicament produces elsewhere. The induction was undoubtedly sound, but a wrong choice of the substances to be employed led to negative and sometimes disastrous results. Will hydriodic ether be more useful? That is a question worthy of being decided by experiment.

ON THE YERBA MATE OF PARAGUAY (PSORALEA GLANDULOSA, LINN.)*

BY M. LENOBLE OF MONTE VIDEO.

According to D'Orbigny the celebrated naturalist, the yerba mate (or South American tea) proceeds from the leaves of the Psoralea glandulosa, which have been slightly roasted and afterwards powdered.

The Psoralea Glandulosa is a wild tree, of the size of an average apple tree; its bark is smooth and whitish; its flowers are polypetalous, arranged in bunches; its seeds are of a violet red, and resembles the seeds of pepper; this leaf very much resembles that of the orange tree.

The infusion of Yerba mate is analogous to that of tea; it has a very aromatic odor as well as a bitter and astringent taste; it is stomachic and stimulant.

I employed the method of displacement for analysing this substance.

Hydrated sulphuric ether, alcohol at 0·81 C., and distilled water were employed at the ordinary temperature.

ACTION OF SULPHURIC ETHER.

This liquid was colored green; it reddened blue litmus paper; mixed with a certain quantity of distilled water, it was decolored at the end of 24 hours; there existed at its surface thin layers of a greenish color.

The ether was driven off by means of a gentle heat; the aqueous liquid was filtered in order to collect the greenish layers; these were insoluble in cold, and soluble in boiling alcohol; they possessed the property of liquefying at a gentle heat, and burning like wax, that is to say, without producing smoke, and leaving a residue amounting to one-third of their weight. The aqueous liquid was examined: it reddened litmus paper, possessed an astringent taste, and formed a black precipitate with sulphate of iron, and a white one of gelatinous appearance, with a solution of gelatine.

ACTION OF ALCOHOL.

This liquid was colored green; it possessed a very aromatic odor and an astringent and bitter taste; it reddened litmus paper, and formed a black precipitate with sulphate of iron, and a dirty grey one with a solution of gelatine; mixed with a small quantity of potassa, it formed a soap, a true salt, which, decomposed by dilute nitric acid, yielded an oleaginous substance of

* *Journal de Pharmacie et de Chimie*; September, 1850.

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agreeable odor, possessing the property of volatilising by the action of heat.

ACTION OF DISTILLED WATER.

This solvent was also colored of a deep green; it possessed a slightly aromatic odor, and its taste was bitter and astringent; it reddened litmus paper, and produced the same precipitate as above mentioned with solutions of sulphate of iron and gelatine. By boiling, a coagulum of albumen and green matter (chlorophylle) was produced; evaporated to dryness, it yielded an extract of a blackish brown color. After having dissolved this extract in distilled water, I boiled it with a small quantity of magnesia; the solution, which was originally of a blackish brown, became yellowish green under the influence of the magnesia.

The liquid, after being filtered, restored the blue color of litmus reddened by an acid. I evaporated this liquid in a sand-bath to the consistence of an extract; this extract was treated with sulphuric ether, which dissolved out a bitter principle, producing by the evaporation of the ether a whitish substance crystallised in needles grouped in fasciculi, and soluble in water, alcohol, and ether; sulphate of iron formed no precipitate; when submitted to a high temperature, it possessed the property, in decomposing, of restoring the blue color of reddened litmus paper, a proof of the presence of nitrogen in this substance.

COMPOSITION OF YERBA MATE.

1. Tannic acid;
2. Chlorophylle;
3. Vegetable wax;
4. Albumen;
5. Volatile oil;
6. Gummy extract;
7. A substance crystallised in needles grouped in fasciculi (psoraleine.)

BISCUITS OF IODIDE OF POTASSIUM.*

BY M. DORVAULT.

IODIDE of potassium... 10 grammes.
Biscuit paste (broken thin)..... q. s.

The iodide is dissolved in its own weight of distilled water, and the solution is thoroughly mixed with the paste; the mass is rolled out, divided by means of a punch, and baked.

This proportion is for 100 biscuits of about 10 grammes each, each of which, consequently, will contain 1 decigramme, or one-hundredth of their weight, of iodide of potassium.

Indications.—These biscuits are indicated in all pathological cases which require iodic treatment.

Dose.—From 1 to 10 biscuits per day.

Dr. Ollivier's excellent method of administering the protochloride of mercury appears to us perfectly applicable to its *alter ergo*—the iodide of potassium. It is true that the protochloride of mercury loses its irritant and poisonous action, by forming a compound with the albumen and the gluten of the farina—a combination which the iodide of potassium does not form. But if the latter salt is not dulcified by a chemical action like the former, it is so, mechanically, by the paste in which it exists, and which prevents its irritant action on the mucous membrane of the digestive tube.

As to the dynamical action of the base, it is not destroyed; on the contrary, its union with an alimentary substance, puts it into a state very fit for absorption into the chyliferous absorbent system, and for acting on the whole of the organism by means of the digestive organs. Indeed, by favor of this association, creating less nervous irritation, it penetrates more surely into the mass of the blood, and arrives in the smallest of the organs.

We must, however, state that the solution of iodide of potassium should be preferred, 1, in cases (and these are the majority) where the patients are not too excitable, and have no objection to taking it; 2, when the symptoms require a large quantity of iodide daily, since it would be difficult to make the patient eat a large quantity of biscuits; 3, as being more economical for the less wealthy class of patients.

But the iodised biscuits may with propriety be ordered in other cases, especially for persons who have a repugnance to medicines in their ordinary forms, for those in which it is necessary to vary them in the course of a long treatment, and for children to whom the medicine is thus presented under the form of a bonbon. For the latter, if they are old enough, the biscuits may be eaten; if very young, the biscuits may be bruised into the form of semola, and soaked. In this manner will be resolved the problem of the iodic treatment by the *elementary* method which MM. Guersaut and Blache tried by means of iodide of starch.

* *Bulletin de Therapeutique.*

ON SULPHATE OF CINCHONINE IN INTERMITTENT FEVER.*

BY DR. THOMSEN (OF SCHWANSEN).

IN consequence of the high price of sulphate of quinine, Dr. Thomsen has in many cases

* *Gazette Médicale.*

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used sulphate of cinchonine instead, and has always found its effects similar to those of sulphate of quinine. Sulphate of cinchonine will not prevent relapses; but it causes the cessation of the attacks as quickly as quinine. Its flavor is not so bitter, and it appears to be more easily endured by the stomach than quinine. On the days which are free from attacks, the patients have taken a powder of 50 centigrammes in three doses. A cup of camomile tea may be given after each dose. Children like this substance better than quinine, and take it more readily, because it is not so bitter. The only cases of intermittent fever which have resisted sulphate of cinchonine have been in persons subject to hemorrhoïds or affected with abdominal plethora; in these cases, sulphate of quinine has caused the disappearance of the attacks of intermittent fever.

Dr. Thomsen reminds us, in favor of cinchonine, that the properties attributed to the cinchona bark are principally due to cinchonine; in fact, with the exception of the royal cinchona, the various species of cinchona contain but little quinine and the royal cinchona became an article of commerce in Europe only so lately as towards 1780.

ON THE USE OF STAPHYSAGRIA.*

BY M. BAZIN.

OINTMENT IN ECZEMA.

Lard..... 32 grammes.
Extract of Staphysagria 4 ,,

ANOTHER OINTMENT.

Lard..... 32 grammes.
Extract of staphysagria. 2 ,,
Oxide of zinc..... 2 ,,

INTERNAL ADMINISTRATION.

Simple julep..... 90 grammes.
Tincture of staphysagria 1 ,,

Augmenting gradually to 10 grammes in eczema.

PILLS.

Extract of staphysagria } of each 4 grms.
Extract of dulcamara.. }

To be divided into pills of 20 centigrammes (3 grs.) each; from 4 to 12 to be taken per day in eczema.

OIL OF VIOLETS.†

BY STANISLAUS MARTIN.

Powdered orris root..... q. v.
Rectified sulphuric ether..... q. s.

The orris root is placed in the apparatus devised by M. Guibourt for preparing the etherial tinctures, and the ether poured on. After fifteen days' maceration, the liquid is filtered, and distilled on a sand-bath, to recover three-fourths of the vehicle employed; to the remaining fourth-part of the liquid is added a sufficient quantity of oil of sweet almonds or olive oil; the small quantity of ether retained in the mixture is evaporated. It preserves its odor without alteration for a long time. In this process, the ether dissolves the essential oil and the resinoïd matter of the orris root; a small portion of the essence is carried off by the distillation, and the remainder gives to the oil an agreeable odor perfectly resembling that of the violet.

When the orris root is distilled with water, a very odorous aqueous tincture is obtained, which may be used for perfuming bonbons and lozenges.

* *Repertoire de Pharmacie.*
† *Bulletin de Therapeutique.*

ON SYRUPS WITH EXTRACTS.*

BY M. LAVIE.

The Codex recommends dissolving the extract in the least possible quantity of water, filtering and adding the solution to a well-boiled syrup. In the first place this is a very long process; besides it is not easy to calculate exactly the evaporation of the water, at least without having recourse to the scales, which is seldom done in laboratories; the syrup, likewise, is either boiled too much or not sufficiently, which obliges the operator either to add water or to continue the concentration. To remedy this inconvenience, I have adopted a process which, I think, has great advantages; it consists in preparing the syrup from the sugar as it is acquired, and removing as much water as is used to dissolve the extract.

I prepare syrup of poppies in the following manner:—

℞ Hydro-alcoholic extract of poppies..... 16 grm.
Distilled Water ..... 125 ,,

Dissolve and filter.

℞ White sugar ..... 1 kilo.
River water ..... 386 grm.

Boil without clarifying, add the solution, boil it for a few moments and strain.

By this means, a syrup is at once obtained boiled to the required degree; besides which, the extract is not subjected to so much boiling, which must improve its quality; for it is certain that the carbonate of lime contained in ordinary water precipitates

* *Repertoire de Pharmacie*, August, 1850.

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morphia during the concentration of the syrup.

All syrups in which extracts are introduced may be prepared in the same manner.

TAYLOR'S PATENT LINT.

We have received, through Mr. W. W. Bonney, four samples of lint, made by the plan for which Mr. Taylor has obtained Her Majesty's Letters Patent, and which is manufactured solely by the National Linen Company. This lint, as appears from a circular accompanying the samples, has received the approval of the Army Medical Board, an approval in which we join, and which, we feel convinced, will be accorded to it by those who use it.

LINIMENT IN CHOREA.*

BY M. BORAND.

R Chloroform..... 50 grammes.
Oil of sweet almonds.. 50 ,,

Mix. Rub a dessert-spoonful along the course of the vertebral column. To be repeated night and morning.

KENT & SON'S VINAIGRE DE BORDEAUX.

We sometime ago received from Messrs. Kent & Son a bottle of this vinegar. The flavor is delicious, and the article very pure. We cheerfully give it our most cordial recommendation.

* *Repertoire de Pharmacie*, Sept. 1850.

IV. REVIEWS, NOTICES OF BOOKS, &c.

THE REPORT OF THE BOARD OF HEALTH ON THE SUPPLY OF WATER TO THE METROPOLIS WEIGHED IN ITS OWN BALANCE AND FOUND WANTING. By J. Neville Warren, C. E. London: Saunders, 4, Charing Cross. 1850. Pamphlet, 18pp., 8vo.

Mr. Warren carefully considers the proposal of the Board of Health for the supply of water to the Metropolis in each of its details, and in each clearly demonstrates its utter inefficiency. His observations are divided into: 1, the selected sources of supply, the quantity they will afford, and the estimated cost of carrying out the proposal; 2, the errors in the money statistics of the Report; 3, the quantity proposed to be supplied per house, and the quantity which ought to be supplied.

The Report states that the gathering-grounds selected include an extent of 150 square miles, and will afford 178 millions of gallons per day; Mr. Warren shews that, in the districts pointed out, there are about 135 square miles of uncultivated land, and that, according to their own data, the quantity of water which can be relied on would only be 47 millions of gallons per day, or 3 millions more than the present supply, which the Board of Health actually proposes to diminish to 40 millions, although it is the opinion of every well-informed man that the present supply is really deficient. The author shews that the Report is at variance with itself in regard to the quantity of water to be expected from the sources it proposes, and is certainly at variance with the statements of respectable authorities and the rules of arithmetic and truth.

The cost of the necessary works will greatly exceed the sum named in the Report. "Their estimate of £1,432,000 does not leave much space for 'Sundries,' after excavating 14½ millions cubic yards for storage reservoirs,—covered aqueducts, at least 20 miles in length, for one portion, and 30 miles for the other,—covered service reservoirs, in duplicate, of course, with a week's supply in each set; having, therefore, a cubical content of above a million yards each, with filter beds,—principal mains from reservoirs, street and branch mains and services, probably many miles in length, and land for works and compensation."

Mr. Warren next notices some of the errors in the money statistics of the Report. In one part of the Report, it is stated, that, by the supply of a softer water, the expense of soap will be reduced one-half; in another, that "the saving in soap will probably be equivalent to the whole of the money at present expended in the water supply." Were the first of these statements correct, the saving would be £226,000 per annum; the second would make it about it about £417,000. But both statements are erroneous. No allowance is made for the

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softening of water by the deposition of earthy matter in boiling for domestic purposes, while this same deposition, in other cases, is used as a reproach against the present water. "At page 48, the Report itself, when arguing upon the evils of lime in water, states 'that the importance of this mineral ingredient is only to be correctly estimated when viewed in the aggregate, when the 16 grains per gallon become in the day's supply of 46 millions, 26 tons of lime; which we find affecting every domestic operation, and *see accumulated as a coating in kettles, in the pipes of baths, in the boilers of steam-engines, and so on.*' And yet, when another argument has to be founded on the waste of soap, it appears that this lime is not deposited in the kettles or boilers, but remains in solution in the water, in order to counteract the effects of soap. Very spiteful!

"But supposing the water used were all cold. Assume Dr. Clark's estimate to be correct that the quantity of water used in washing clothes amounts to 400 gallons per annum per individual. Only half that quantity is used with soap, the rest being used for rinsing &c., so that the loss according to the writer of p. 72 of the Report would be 1s. 4d. per head per annum, or a total of £150,000 in a population of 2¼ millions. Thus the saving in soap by using a soft water instead of Thames water—

According to p. 72, would amount annually to..... £150,000;
according to p. 284..... £226,000;
and according to p. 321..... £417,600.

Against this it may be stated that Professor Clark's estimate of the saving of soap in London by the use of a softer water than that which is at present distributed, would be £63,000."

The quantity of water at present supplied per house is an average of 146 gallons; this the Commissioners propose to reduce to 75 gallons, which Mr. Warren shows to be too little; he insists, and most properly, on 100 gallons per day. We subjoin the quantities proposed by the Board and by Mr. Warren. The Board of Health proposes

"1. An improved domestic supply of 75 gallons per diem to 288,000 houses.....	Gallons. 21,600,000
2. Supply for new Baths....	1,000,000
3. Supply for the general surface cleansing of courts, foot pavements, and the carriage ways of paved streets, and street watering	10,000,000
New demands for brewers and other large consumers....	4,000,000
Fires and contingencies.....	3,400,000
	40,000,000."

Mr. Warren suggests—

"1. An improved domestic supply of 100 gallons per diem to 288,000 houses.....	Gallons. 28,800,000
2. Supply for new baths....	2,000,000
3. Supply for the general surface cleansing of courts, foot pavements, and the carriage ways of paved streets and street watering, *fountains, and the washing out of service pipes and waste*.....	17,000,000
New demands for brewers and other large consumers—moderate at.....	4,000,000
Fires and contingencies.....	3,700,000
	55,500,000

The author concludes by calling on Parliament and the public not to adopt the plan proposed by the Board, and certainly he has shown sufficient cause for its rejection.

This pamphlet is by far the most able exposé of the inaccuracy of the effusion of Gwydir House that we have seen, and we earnestly recommend every one interested in the great subject of which it treats (and who is not?) to carefully peruse it, and, relying in its statements, which will bear the test of the most rigid investigation, to oppose the adoption of the odious and unscientific plan which it so justly condemns.

TO CORRESPONDENTS.

"M. I."—Apply to a Bookseller.

"M.P.S."—We agree with you as to the importance of an immediate and powerful movement.

Numerous correspondents, having sent their addresses for the purpose, have been answered by post, a course which we often find more convenient than devoting considerable space to such matters.

"A. B."—Sulphuric ether will answer your purpose.

"EGOMET" will oblige by forwarding his address, that we may reply by post.

"CHEMICUS" is quite right.

NOTICE.—*All Communications, Books for Review and Substance for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON THE ARTIFICIAL FORMATION, BY THE HUMID WAY, OF CERTAIN KINDS OF MINERALS WHICH MAY BE PRODUCED IN HOT SPRINGS UNDER THE COMBINED INFLUENCE OF HEAT AND PRESSURE.*

BY M. H. DE SENARMONT.

MANY species of minerals which constitute the crystallised rocks or fill the metallic veins, have not yet been obtained by the ordinary processes of chemistry; still the artificial reproduction of these natural compounds would be equally interesting to the chemist and to the geologist.

Their elements do not appear, indeed, to have always obeyed the same order of affinities which we know to be in force in the various operations of the arts and in the experiments of the laboratory. It must, therefore, be concluded from the very existence of these minerals, that with another set of physical conditions and external influences, the reactions and chemical affinities may be subject to other laws, and that we are acquainted with only the limited field of science which can be beheld from our particular point of view.

It is, besides, no less evident that a precise definition and a strict limitation of the conditions especially adapted for the production of each kind of mineral would throw considerable light on the phenomena which must have occurred on the surface of the earth during the different geological periods; and if we should ever become acquainted with some peculiarities of its former history, this method is probably the only one which can reveal them to us.

An attentive examination, and a careful discussion of purely geological facts may, it is true, supply some data, and some appear to be already in the possession of science. Thus geology now distinguishes crystallised rocks of different natures, and different kinds of metallic veins: it knows, or suspects, to what agents, to what order of chemical reactions the phenomena which have produced them may be assimilated; but it necessarily stops short at general views, at rather vague approximations, and would depart from this wise reserve only to wander into empty theories or barren hypotheses. Experiment alone can go farther: now, mineralogical geology has, at present, no experimental guide but chemistry.

Chemical analysis elucidates, however, only one side of the question. We are but very imperfectly acquainted with a mineral, even when we have determined its elementary composition, or even the atomic laws which govern its combinations; it still remains to be discovered in what necessary conditions each of them may be produced. Analysis is evidently silent on this point; synthesis must, therefore, complete that which is left unfinished.

MM. Mitscherlich and Berthier have opened this fruitful way; they have found in the products of several metallurgical establishments, and have obtained by the dry way, several kinds of fusible minerals which are met with in eruptive rocks. M. Ebelmen has formed or crystallised at a very high temperature, and in very peculiar conditions, infusible substances. Moreover, M. Gay-Lussac, and after him, M. Daubrée, have imitated certain products which the mutual decomposition of steam and some volatile chlorides forms in the volcanoes and

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in burnt coal mines; finally, several phenomena have found an explanation in the reactions of the humid way. M. G. Rose has skilfully analysed the conditions of the precipitation of carbonate of lime in the state of Arragonite, and a beautiful experiment of M. Haidinger, in giving a striking confirmation of the conjectures of MM. Buch and Elie de Beaumont on the formation of some dolomites, has thrown great light on this question, which has been so controverted, and on the general problem of metamorphism. We are also indebted to M. Becquerel for a great number of ingenious experiments on the long-continued action of a very weak current of electricity. He has thus produced some kinds of minerals and a great number of compounds which appear to escape the ordinary means of chemistry.

These various processes, which are interesting to science, and which, at any rate, show the resources at her disposal, are not, probably, all those of nature. Several of them appear even irreconcilable with certain peculiarities of association or of situation of minerals; and, to mention only one example, the constant occurring together of diaspore and corindon excludes, perhaps, in the formation of the latter, the intervention of excessive heat and the ordinary reactions of the dry way. It is not sufficient, moreover, that a mineral may be formed in certain peculiar conditions for it to follow that it must always and necessarily be thus formed. We shall, therefore, be certain of having imitated nature only when we know within what limits a compound begins or ceases to be produced, and when we have exhausted all the combinations of agents of every kind, which it can vary *ad infinitum*.

In the absence of this precise method, in investigations of this kind, we must resort to induction, taking as a guide the study of the metallic beds; and it may be advisable to endeavor to imitate the phenomena which we have daily before our eyes. They represent to us, doubtless, more or less faintly, those which must always have been produced on the surface of the globe. Everything demonstrates, indeed, that nature has not interrupted the mineral creation, and it may be believed that it scarcely changes the means and the agents which it employs.

A numerous class of metalliferous lodes is very probably formed by way of solution. The crystals and the stalactites which supply them, and more still the general structure of the mass circumscribed and concreted parallel to the *salbebandes*, sufficiently demonstrate this origin. Everything, therefore, tends to show that these lodes are no other than vast canals of circulation more or less obstructed, percolated by incrusting waters.

Among the mineral substances most abundant in lodes of this nature, are found however, certain carbonates and some sulphurets of which this hypothesis does not, so far, sufficiently explain the formation, because they have not hitherto been reproduced by the humid way; although several of these compounds may, besides, naturally take their place beside the best defined products of the laboratory, and may even fill the gaps which the latter still leave in different natural series.

It was necessary, therefore, to determine the special conditions which have modified, in these subterranean canals the ordinary chemical reactions, and it was so much the more rational to try at once the influence of a high temperature combined with powerful pressure, because, in the first place, analogous compounds in the state of hydrates are readily formed at the ordinary temperature, and because, in the second place, it is proved that heat favors dishydratation, even in liquids.

ARTIFICIAL FORMATION OF THE CARBONATES.

I arranged the experiment in two different manners: the first consists in producing in hermetically closed vessels, at a high temperature, the double decomposition of a soluble salt and of a neutral soluble or insoluble carbonate. (Carbonate of soda or carbonate of lime.)

The substances to be mutually decomposed are put together in glass tubes sealed in a lamp after a vacuum has been formed, and, when they are of a nature to react immediately on each other, they are placed in separate tubes; they may be mixed at the proper time. One of the solutions may also be enclosed with a bubble of air in a thin bulb: the dilatation of this air breaks the bulb when the heat becomes sufficiently powerful.

Thick and sufficiently narrow glass tubes support considerable pressure; they may be rendered capable of resisting enormous efforts by placing them in a metallic gun-barrel hermetically closed, and almost filled with water. The tension of the steam within and without then maintains the equilibrium on both sides of the glass tubes.

It is difficult, nevertheless, to close the gun-barrel so as to avoid all escape, and when we heat for a long time, this second envelope empties itself and becomes useless.

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Tubes of green glass should be selected; tubes of soft glass are powerfully attacked by over-heated water.

The other method consists in precipitating a soluble salt by an alkaline bicarbonate in water supersaturated with carbonic acid which is disengaged slowly at a high temperature. This operation evidently imitates the slow precipitation of the carbonates dissolved in an excess of carbonic acid.

A glass bulb containing the soluble salt is placed in a thick stone bottle almost full of a solution of bicarbonate supersaturated with acid; the bottle is afterwards stopped with a cork, plaster or baked clay, difficultly permeable to the gas, but which still allows it to escape under very powerful and prolonged pressure. The bulb is broken, at the proper moment, by agitation, or by means of a rod passing through the cork.

I deposited the tubes horizontally or upright, and the bottles upright on the dome of the gas furnaces of the manufactory of Ivry. By covering them with charcoal dust, and by selecting the place, I was enabled to obtain nearly uniform temperatures, from 212° F. to redness; a thermometer, immersed in the charcoal dust, indicated the temperature not very accurately, and, besides, it was not perfectly invariable.

It is important to guard against explosions, which are frequent and very violent, notwithstanding the smallness of the quantity of the liquid.

CARBONATE OF MAGNESIA ($MgCO^2$).

M. Marignac produced this salt by making chloride of magnesium react on carbonate of lime: I obtained it by the double decomposition of neutral carbonate of soda and sulphate of magnesia at about 320° F., and by disengaging at about 300° F. the excess of acid from a solution of carbonate of magnesia in carbonic acid.

The carbonate of magnesia is a white crystalline sand scarcely attackable by dilute acids, composed of transparent rhombohedrons recognisable by the microscope.

A solution of magnesia in carbonic acid, mixed with chloride of calcium, does not immediately become turbid. If the acid be allowed to dissipate freely at the ordinary temperature, or if it be heated in an imperfectly closed vessel at different temperatures, different products are obtained.

At and below 212° F., when the quantity of chloride is more than equivalent to the quantity of magnesia in solution, carbonate of lime is alone obtained, without any trace of magnesia.

At 302° F., with a quantity of chloride of calcium either more or less than equivalent to the magnesia contained in the solution, the precipitate is carbonate of magnesia containing scarcely any traces of lime.

Dolomite in atomic proportions (if it exists as a definite mineral species) would correspond to an intermediate temperature: I had not any sufficiently easy means of regulating the heat for resolving this interesting question.

	I.	II.	III.	IV.	V.	Calculated composition.
Magnesia	0·48	0·476	0·48	0·421	0·482	0·484
Lime....	„	„	„	0·070	„	„
Carbonic acid by the difference.	0·52	0·524	0·52	0·509	0·518	0·516
	1·00	1·000	1·00	1·000	1·000	1·000

I. and II. Products of the decomposition at 320° F. and 347° F. of carbonate of soda and sulphate of magnesia.

III. Product of the disengagement at about 311° F. of the excess of carbonic acid in which the carbonate of magnesia was dissolved.

IV. and V. Products of the disengagement at about 302° F. of the excess of carbonic acid employed in dissolving the carbonate of magnesia, in presence of a quantity of chloride of calcium more than equivalent and less than equivalent to the magnesia dissolved.

CARBONATE OF IRON ($FeO\ CO^2$).

The carbonate of iron is obtained in the state of a greyish-white crystalline sand, almost unalterable in the air, and very slowly acquiring, even in humid air, a faint light color. This sand is composed of transparent octohedrons, sometimes very distinct under the microscope; it has all the properties of spathic iron.

It is so much the whiter and more unalterable, as it has been prepared with a salt more completely free from peroxide. Its grey tint appears, ceteris paribus, to be so much the deeper, and its spontaneous alterability so much the less, as it is formed at higher and longer-maintained temperatures. Perhaps we may attribute to some circumstance of this kind the differences which native spathic iron presents in this respect, which differences their variable composition do not always sufficiently explain.

In the following analyses, the carbonic acid was sometimes estimated, and the oxide of iron by the difference.

1. The residue of the calcination, peroxidised by a few drops of nitric acid, calcined *de novo*, was reduced to the minimum by calculation.

2. The carbonate, calcined with oxide of copper, gave up its acid, which was collected and weighed as in an organic analysis. This

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process was likewise employed in the analysis of the carbonates of magnesia, cobalt and nickel.

	I.	II.	III.	IV.	V.	Calculated composition.
Protoxide of iron.....	0·515	0·62	*0·62	*0·619	*0·623	0·621
Lime.....	0·095	,,	,,	,,	,,	,,
Carbonic acid	*0·393	*0·38	0·38	0·381	0·377	0·379
	1·000	1·00	1·00	1·000	1·000	1·000

The numbers to which an asterisk is prefixed were obtained by the difference.

I. and II. Products of the reaction of carbonate of lime on protochloride of iron, at temperatures of 275° F. and 356° F., kept up for 12 and 18 hours.

III. Product of the double decomposition, at above 392° F., of sulphate of iron by bicarbonate of soda.

IV. Product of the double decomposition, at about 302° F., of protochloride of iron and a solution of bicarbonate of soda supersaturated with acid.

V. Product of the double decomposition, at 266° F., of sulphate of iron and bicarbonate of soda supersaturated with acid.

CARBONATE OF MANGANESE ($MnO\,CO^2$).

This carbonate, unalterable at 212° F., but readily soluble in the acids, occurs, when it is obtained by the first process, as an excessively fine white powder with a slight rose tint, in which crystalline grains can be distinguished only with the aid of considerable magnifying power. The second process of preparation gives a more crystalline product. The microscope displays in it transparent grains grouped in stars, acting on polarised light, but whose form it is not very easy to recognise.

	I.	II.	III.	Calculated composition.
Protoxide of manganese	0·612	*0·615	*0·609	0·618
Carbonic acid	*0·388	0·385	0·391	0·382
	1·000	1·000	1·000	1·000

The numbers to which an asterisk is prefixed were obtained by the difference.

I. Product of the double decomposition of chloride of manganese and carbonate of lime towards the temperature of 302° F., maintained for 18 hours.

II. Product of the double decomposition, at about 320° F., of chloride of manganese and carbonate of soda.

III. Product of the double decomposition, at about 302° F., of chloride of manganese and a solution of bicarbonate of soda supersaturated with acid.

CARBONATE OF COBALT ($CoO\,CO^2$).

Crystalline sand, of a light rose color, composed of transparent rhombohedrons, recognisable with the microscope, and unattackable cold by even concentrated hydrochloric and nitric acids.

	I.	II.	Calculated composition.
Protoxide of cobalt (by the difference)	0·627	0·633	0·63
Carbonic acid....	0·373	0·367	0·37
	1·000	1·000	1·00

I. Product of the double decomposition of chloride of cobalt and carbonate of lime at the temperature of 302° F., maintained for 18 hours.

II. Product of the double decomposition, at 140° F., of chloride of cobalt and a solution of bicarbonate of soda supersaturated with acid.

Carbonate of cobalt has not hitherto been met with in nature in a pure state, but it exists to the amount of 0·13 in a cobaltiferous carbonate of lime of Pzibram in Bohemia.

CARBONATE OF NICKEL ($NiOCO^2$).

Crystalline sand, of a greenish white, composed of transparent rhombohedrons recognisable by the microscope; unattackable cold by even concentrated hydrochloric and nitric acids.

	I.	II.	Calculated composition.
Protoxide of nickel (by the difference)	0·63	0·626	0·631
Carbonic acid....	0·37	0·374	0·369
	1·00	1·000	1·000

I. Product of the double decomposition of chloride of nickel and carbonate of lime at the temperature of 302° F., maintained for 18 hours.

II. Product of the double decomposition, at 284° F., of chloride of nickel and a solution of bicarbonate of soda supersaturated with acid.

The neutral carbonate of nickel also does not appear ever to have been found in nature, either pure or in the state of mixture; it will doubtless be found at some future time.

CARBONATE OF ZINC ($ZnOCO^2$).

This carbonate, unalterable at a moderate heat, but readily soluble in the acids, occurs, when formed by the first process, as an extremely fine white powder, in which crystalline grains can be distinguished only by powerful magnifying power. The second process of preparation gives a more crystalline product; the microscope exhibits in it transparent grains, often irregularly grouped, and acting on polarised light, but whose form it is not easy to recognise.

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	I.	II.	III.	Calculated composition.
Oxide of zinc..	0·639	0·636	0·635	0·648
Carbonic acid (by the difference)....	0·361	0·364	0·365	0·352
	1·000	1·000	1·000	1·000

The products I., II. and III. were prepared in the same circumstances as the corresponding products of manganese.

The neutral carbonate of copper (mysorine) and the blue hydrocarbonate appear to require conditions of temperature which I have not yet succeeded in realising. I have regularly obtained only the green carbonate, whose composition corresponds to that of malachite.

ARTIFICIAL FORMATION OF SOME SULPHURETS.

A great number of metallic sulphurets are readily precipitated by the humid way in laboratories; those only which have not yet been produced in this manner will be treated of here. I obtained them by the double decomposition, at a high temperature, of a soluble metallic salt, and of a more or less sulphuretted alkaline sulphuret.

When the double decomposition precipitates sulphur in excess, the latter fuses into globules and separates.

I enclosed the alkaline sulphuret in a tube empty of air, with a bulb containing the metallic salt, and a bubble of air to break it.

BISULPHURET OF IRON (FeS^2).

An amorphous black dust, sometimes adhering as a yellow metalloid covering on the sides of the glass tube; scarcely alterable in the air when it is moistened, unalterble when it is dry; combustible; unattackable by hydrochloric acid. Bisulphuret of iron thus prepared, and exposed to the air for more than a year, was not converted into sulphate, notwithstanding its fine state of division. It is therefore very probable that this product corresponds to yellow pyrites. Bisulphuret of iron formed, at the ordinary temperature, by the slow reaction of the sulphurets on decomposing organic matters, effloresced, on the contrary, very rapidly, and appeared to be a white pyrites.

	I.	II.	Calculated composition.
Iron ...	0·454	0·458	0·467
Sulphur .	0·541	0·545	0·533
	0·995	1·003	1·000

I. Product of the double decomposition, at 329° F., of sulphate of iron and persulphuret of potassium.

II. Product of the double decomposition, at 356° F., of protochloride of iron and persulphuret of potassium.

SULPHURETS OF MANGANESE.

Protosulphuret (MnS).

Amorphous black dust, sometimes adhering as a steel-gray covering to the sides of the vessel; rather alterable in humid air; it appears unalterable in dry air. This sulphuret is prepared with an alkaline protosulphuret. When the latter contains an excess of sulphur, the product contains bisulphuret of manganese; when it contains an excess of alkali, the product contains some oxide. An alkaline protosulphuret mixed with carbonate would give a sulphuret of manganese itself, mixed with carbonate like the native sulphuret.

		Calculated composition.
Manganese.....	0·625	0·633
Sulphur (by the difference)	0·375	0·367
	1·000	1·000

The product was obtained at 365° F.

Bisulphuret (MnS^2).

Amorphous brick-red dust, sometimes adhering as a transparent red covering to the sides of the tubes; scarcely alterable in the air when it is moistened, and quite unalterable when it is dry. This compound corresponds to hauerite; it is obtained, like the preceding, with an alkaline persulphuret.

	I.	II.	Calculated composition.
Manganese...	0·462	0·460	0·468
Sulphur.....	0.533	0·535	0·532
	0·995	0·995	1·000

I. Product obtained at 320° F.
II. Product obtained at 356° F.

SULPHURET OF COBALT (Co^3S^4).

Amorphous dust, of a black grey, unalterable in dry air.

		Calculated composition.
Cobalt (by the difference)	0·573	0·58
Sulphur.....	0·427	0·42
	1·000	1·00

Produced at 320° F. with chloride of cobalt and persulphuret of potassium; this compound appears to be identical with the native sulphuret.

SULPHURETS OF NICKEL.

Protosulphuret (NiS).

Amorphous powder, of a black grey; unalterable in dry air; adhering to the sides of the tubes as a yellow metalloid covering.

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		Calculated composition.
Nickel (by the difference)	0·637	0·649
Sulphur	0·360	0·351
	0·997	1·000

Product obtained at 320° F., with chloride of nickel and a protosulphuret of potassium.

Sulphuret (Ni^3S^4).

The same characters; likewise forms on glass a yellowish metalloid covering.

		Calculated composition.
Nickel (by the difference)	0·583	0·581
Sulphur	0·417	0·419
	1·000	1·000

Product obtained at 320° F., with chloride of nickel and persulphuret of potassium.

This sulphuret, like that of cobalt, appears to correspond to magnetic pyrites.

SULPHURET OF ZINC (ZnS).

Amorphous white dust, unalterable in dry air. This sulphuret has the composition of blende, whatever may be the state of saturation of the alkaline sulphuret.

		Calculated composition.
Zinc	0·662	0·670
Sulphur	0·443	0·330
	1·005	1·000

Product prepared at 347° F.

All the sulphurets thus prepared by sudden double decomposition are almost amorphous; they take the metalloid state and color only in being applied to glass. However, they are found crystallised in nature; they must, therefore, have been formed slowly, or have undergone the action of a solvent.

Hydrosulphuric acid appears to be, in certain conditions of temperature and pressure, a solvent of the metallic sulphurets. Indeed, I have been enabled to dissolve some of them by means of this gas; but the experiment presents some difficulties, and we can operate on only very small quantities of matters.

Hydrosulphuric acid, indeed, is sparingly soluble in water, and, besides, of itself, has only a very feeble solvent power. This faculty appears, it is true, to increase with the temperature; but a great increase of pressure is required to retain the gas united to the liquid.

Into a thick glass tube of small bore, almost filled with boiled water, I introduced a few parcels of metallic sulphuret and bisulphuret of hydrogen; the tube exhausted of air, was then hermetically sealed. The decomposition of the bisulphuret of hydrogen very soon gave a solution more or less charged with hydrosulphuric acid, at the same time as a deposit of sulphur, which however presented no inconvenience. The tube was exposed to heat, and the sulphuret, at least partially dissolved, was found to have a crystalline appearance.

Heat appears to disengage the hydrosulphuric acid from its solution, for violent explosions occur. This gas appears to differ from carbonic acid, because it dissolves the sulphurets less easily than the latter does the carbonates, and because it is less soluble in water when the temperature increases; so that at equal heat, its solutions should possess more powerful tension.

This difference would explain very well the concentration of the sulphurets at a depth in all metalliferous beds, and the accumulation of carbonates in the upper part of them, since the solvent faculty of hot waters saturated with the two gases diminishing in proportion as the latter would be disengaged unequally under a decreasing hydrostatic pressure, the dissolved matters should be precipitated gradually, the sulphurets before the carbonates.

I will add to the foregoing experiments some results which have no immediate application to the formation of concreted veins, but which, perhaps, are not uninteresting in a geological point of view.

Very finely divided amorphous anhydrous oxide of iron is diffused in many geological formations, and its beds presents a double character.

Sometimes it impregnates a whole collection of rocks of mechanical formation, evidently stratified, and which have not undergone any important derangement since their deposit; so that it is impossible to help regarding the oxide of iron as precipitated in the anhydrous state in the water which held in suspension the muddy and sandy matters. Sometimes the presence of the anhydrous oxide is local, and evidently related in neighborhood and origin to certain eruptive mineral masses.

In these two essentially different metallic veins the oxide of iron frequently accompanies dolomites, rock salt, anhydrites, and gypsum; and although these matters show themselves in different manners, the narrow connection of age and metallic vein existing between them, their enduring association, even in general conditions of formation absolutely opposed, prove that so constant a concurrence of effects could not be fortuitous, and permit us to see in it only various products of the same natural operation. It must therefore be concluded that the same

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phenomena or at least analogous phenomena have occurred in the liquid masses which deposited certain stratified rocks, and have accompanied the appearance of certain eruptive rocks.

It is already known from Haïdinger's beautiful experiment, that dolomite and anhydrite may be a double epigenic product of the reaction by the humid way of sulphate of magnesia on carbonate of lime; from the foregoing experiments it results that calcareous magnesian salts and even pure carbonate of magnesia will be deposited in certain cases in superheated waters; perhaps a step may have been made towards the solution of the problem if we show that the dishydratation of the sesquioxide of iron is operated in the same conditions, and does not necessarily suppose reactions comparable to those in the dry way.

I decomposed a solution of perchloride of iron by carbonate of lime or carbonate of soda at a temperature of at least 392° F. maintained for forty-eight hours, and I obtained a precipitate of very finely divided red, anhydrous oxide of iron, sparingly soluble in nitric acid. I repeated this experiment with the same results at temperatures between 320° F. and 356° F., maintained for eight days; finally, I dishydrated, in the same conditions, the hydrated peroxide of iron in suspension in a saturated solution of common salt or chloride of calcium, and in pure water. Nothing, however, indicates that these temperatures were the lowest at which the same effects could be obtained.

If it now be remarked that the sulphate of lime is precipitated anhydrous in a superheated liquid, and that the solubility of carbonate of soda, superior to that of chloride of sodium, increases much more rapidly with heat; we may take as a basis the reactions which have just been separately studied, and which are comparatively simple, in order to arrive at a conception of the complex phenomena which have given rise to the above-mentioned multiple association of mineral matters.

These phenomena may, indeed, be explained, if not in their details, at least collectively, by various combinations which would likewise satisfy the general data of the problem; it would be sufficient, for example, that waters charged with chlorides of calcium, magnesium and iron become mixed, under certain conditions of temperature, and, consequently, of pressure, with waters saturated with carbonate and containing more or less sulphate of soda, in order to give rise at the same time to deposits of calcareous magnesian salts, of anhydrites, red oxide of iron and rock salt.

ON THE EMPLOYMENT OF HYDROGEN IN THE ANALYSES OF MINERAL SUBSTANCES.*

BY M. L. E. RIVOT, MINING ENGINEER, DIRECTOR OF THE LABORATORY OF THE SCHOOL OF MINES.

THE reductive action exerted by dry hydrogen gas, at a more or less elevated temperature, on certain metallic oxides, may be employed with great advantage for separating these oxides from other fixed bases, on which hydrogen gas has no action at any temperature. To the investigations already made with the view of turning this action to account, I think I may add the results of several separations, and of several analyses, difficult of performance by the processes hitherto employed. By employing hydrogen, I have been enabled to separate oxide of iron from the earths, alumina, glucina and zirconia; oxide of iron from oxide of chromium; and oxide of tin from silica.

I will first explain the method of separation and the results which I have obtained, and will afterwards point out the process of analysis on which I decided for chrome iron ore and native oxide of tin.

SEPARATION OF OXIDE OF IRON AND ALUMINA.

The process of separation described in the various treatises on chemical analysis consists in treating the weighed mixture of the two oxides by potassa, either by the dry way in a silver crucible, or by the humid way, after solution in an acid, in separating the oxide of iron and washing it thoroughly in boiling water. This process is very long, and often inaccurate, when the potassa employed is not perfectly pure. The separation of the two oxides of lead being very often required in the analysis of mineral substances and the products of manufactories, I sought for a quicker and more accurate process. I have obtained very accurate results by reducing, by dry hydrogen, at a bright red heat, the weighed mixture of oxide of iron and alumina, precipitated by ammonia from an acid solution, allowing it to cool in the hydrogen, and afterwards treating with very dilute cold nitric acid the mixture of alumina and metallic iron; the iron dissolves very easily, whilst the alumina is not attacked.

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Very few details are necessary for explaining the mode of operation.

The oxide of iron and alumina are precipitated together by ammonia; the precipitate is dried and separated from the filter; the filter is burned, and the ashes are united to the two hydrates; the whole is calcined in a platinum crucible at a full red heat. The mixture of the two oxides is porphyrised and accurately weighed, then placed in a porcelain boat, likewise weighed, in a porcelain tube placed horizontally in a reverberatory furnace. To one of the extremities is adapted a glass tube drawn out at one end; at the other a gentle stream of hydrogen is passed in, being dried by passing through a tube containing chloride of calcium, and a flask containing monohydrated sulphuric acid.

When the air of the apparatus is completely expelled, the porcelain tube is gradually heated to bright redness, and this temperature is maintained so long as water is deposited on the sides of the glass tube at the extremity of the apparatus. In none of my experiments has it taken more than an hours' heating to accomplish the reduction.

The tube is then allowed to cool, the current of hydrogen being continued. When the tube is quite cold, the porcelain boat is removed and weighed. The loss of weight indicates the oxygen of the peroxide of iron, and permits its proportion in the mixture to be calculated. However, it is not advisable to be satisfied with this determination: when the alumina is in large proportion, and when care has not been taken throughout to make the gas pass in very slowly, a little alumina may be carried away by the hydrogen, and, consequently, the loss of weight would lead to rather too large a proportion of peroxide of iron.

The mixture of metallic iron and alumina is digested for twenty-four hours without heat, in very weak nitric acid. The ordinary pure acid must be employed diluted with at least thirty times its bulk of water, or, better still, acid much more diluted, or pure water, adding at different times small quantities of nitric acid, so as to maintain a very slow effervescence of hydrogen gas; by operating thus, we are certain to completely dissolve the iron without attacking the alumina. The solution of the iron is complete when the alumina has become nearly white.

The alumina is separated by filtration. In the nitric solution, previously heated to peroxidise the iron, the peroxide of iron is precipitated by ammonia. In this manner, the two oxides separated may be weighed.

When the proportion of alumina is very small, we are led to a very accurate result by the sole loss of weight of the mixture in the hydrogen, considered as representing the oxygen of the peroxide of iron.

I examined the following mixtures carefully weighed:—

	I.	II.	III.
	gr.	gr.	gr.
Alumina.....	0·500	0·152	0·053
Peroxide of iron	0·500	0·427	0·526

I obtained the following numbers:—

	I.	II.	III.
	gr.	gr.	gr.
Loss of weight in the hydrogen	0·156	0·132	0·1616
Corresponding to Peroxide of iron....	0·510	0·431	0·527

By weighing afterwards the oxide of iron and alumina, separated by weak nitric acid, as already explained, I obtained:—

	I.	II.	III.
	gr.	gr.	gr.
Alumina	0·492	0·148	0·052
Peroxide of iron	0·498	0·428	0·524

From these numbers it results that the separation of the two oxides by the process pointed out is very accurate: that the two oxides may be accurately estimated by weighing directly the peroxide of iron, and calculating the alumina by the difference; and, finally, that the loss of weight in the hydrogen leads to rather too high a proportion of peroxide of iron when the quantity of alumina is somewhat considerable, owing to the latter being carried away by the gaseous current, and on the contrary, to a very accurate result when the quantity of alumina is small.

I must remark that, if the hydrogen be passed into a mechanical mixture of alumina and oxide of iron instead of operating on the mixture of the two oxides precipitated by ammonia, the alumina is much more easily carried away by the current of gas.

To calculate the quantity of peroxide of iron from the loss of weight in the hydrogen, I took for the equivalent of iron, the number formerly admitted, 339. It is that to which two experiments, made with the greatest care, by the reduction, in hydrogen gas, of 1 gramme (15·434 grs.) of very pure peroxide of iron led me.

I obtained:—

	I.	II.
	gr.	gr.
Metallic iron	0·6931	0·6935

and the mean of these two very approximate numbers leads almost exactly to the number 339 for the equivalent of iron.

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SEPARATION OF OXIDE OF IRON AND ZIRCONIA.

The separation of these two bases, by the reductive action of hydrogen on the peroxide of iron, is effected with the same facility and the same accuracy as that of oxide of iron and alumina. The result obtained by weighing zirconia is more accurate, because this earth, being heavier than alumina, is not perceptibly carried away by the gaseous current. We may also use nitric acid less diluted to dissolve the iron reduced to the metallic state, because calcined zirconia does not dissolve at all in the acids.

I submitted to experiment the mixture:—

Peroxide of iron ..... gr. 0·660
Zirconia ..... gr. 0·377

I obtained the following results:—

Loss of weight in hydrogen ..... gr. 0·205
corresponding to
Peroxide of iron ..... gr. 0·667

Afterwards by weighing the zirconia and oxide of iron, I obtained:—

Zirconia ..... gr. 0·375
Peroxide of iron ..... gr. 0·668

These numbers prove that the separation of the two oxides by the means proposed is quite accurate, and that the composition of the mixture may be deduced from the loss of weight resulting from the action of the hydrogen, considered as the oxygen of the peroxide of iron.

This process of separation is more rapid and more accurate than those hitherto proposed.

SEPARATION OF OXIDE OF IRON AND GLUCINA.

This separation, made with the same precautions as that of alumina and oxide of iron, leads to quite as accurate results. Glucina, like alumina, may be carried away by the current of gas, when its quantity is considerable; and, consequently, when the glucina is in large proportion, the composition of the mixture should not be determined solely by the loss of weight resulting from the action of the hydrogen.

The metallic iron must be dissolved in dilute nitric acid without heat. The acid to be used should not contain less than thirty parts of water to one part of ordinary pure acid.

I submitted to experiment the mixture:—

Peroxide of iron ..... gr. 0·815
Glucina ..... gr. 0·399

I obtained the following numbers:—

Loss of weight in hydrogen ..... gr. 0·249
corresponding to
Peroxide of iron ..... 0·812

On afterwards treating the mixture of metallic iron and glucina by dilute nitric acid, I found:—

Peroxide of iron ..... gr. 0·816
Glucina ..... gr. 0·397

The process indicated succeeds therefore very well for glucina and oxide of iron.

I have not made any experiments as to the separation of oxide of iron from yttria and thoria.

The reductive action of hydrogen on the oxides of cobalt and nickel, may usefully be applied to their separation from alumina.

When, in an acid solution containing the oxides of cobalt and nickel with alumina, the alumina is precipitated by ammonia, the precipitate retains a certain proportion of oxides of cobalt and nickel. Quite pure alumina may be obtained by calcining the precipitate given by ammonia, and treating it by dry hydrogen, and afterwards, like the mixture of iron and alumina, by very dilute cold nitric acid, which dissolves only the cobalt and nickel.

SEPARATION OF OXIDE OF TIN AND SILICA.

The reductive action of hydrogen on oxide of tin may be employed with advantage for the accurate separation of oxide of tin and silica.

I operate in the following manner;—

The mixture of oxide of tin and silica, strongly calcined and weighed, is placed in a porcelain boat likewise weighed,—in a porcelain tube as in the experiment already described. The hydrogen is made to pass in very slowly, in order that the silica may not be carried away by the gaseous current, and heated only to dull redness. The reduction of the oxide of tin takes place very rapidly. After cooling in hydrogen, the mixture of metallic tin and silica is presented under the form of a grey powder, without metallic globules, at least if the temperature be not carried too high, or if the oxide of tin be not nearly pure. It is weighed: the loss of weight gives the oxygen of the oxide of tin and enables us to calculate approximatively the composition of the mixture. However, as the silica may have been carried away in small quantity by the gaseous current, it is better to dissolve the metallic tin in nitro-hydrochloric acid, to weigh the undissolved silica, and, when the weight does not exactly correspond with the quantity of silica calculated from the loss sustained by the mixture in hydrogen, to estimate the oxide of tin in the nitro-hydrochloric solution. The process which I found most successful in this estimation is the following:— I saturate the acids with ammonia; I add sufficient hydrosulphate of ammonia to completely dissolve the tin; I decompose the sulphosalt of tin with hydrochloric acid,

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which gives the metal in the state of sulphuret. The sulphuret after being well washed, is carefully roasted, and converted into oxide of tin.

I submitted to experiment the following mixtures :—

	I	II
	gr.	gr.
Oxide of tin	0·310	0·500
Silica.....	0 644	0·500

I obtained

Loss of weight by hydrogen..	0·069	0·106

Calculating the oxide of tin according to these numbers, I should have had for the composition of the mixtures :—

	gr	gr.
	1	II
Oxide of tin	0·324	0·509
Silica.....	0·630	0·491

There was a considerable error and excess in the quantities of oxide of tin.

By treating with nitro-hydrochloric acid, and by estimating the tin by the method already indicated, I obtained :—

	I	II
	gr.	gr.
Insoluble silica.....	0·636	0·496
Oxide of tin.....	0·307	0·497

These numbers prove that the error committed, in considering as the oxygen of the oxide of tin the loss of weight by hydrogen, arose from a small portion of silica being carried away by the current of gas. This mechanical carrying off of the silica by the gaseous current, may be neglected and the loss of weight in hydrogen regarded as oxygen only when the silica is in very small quantity. When the quantity of silica is rather large, the tin must always be estimated, and the silica calculated by the difference.

TIN ORES.

The ores of oxide of tin may be analysed very rapidly by means of dry hydrogen. When well ground tin ore is gradually heated to redness, in a current of dry hydrogen, the oxides of iron and tin are completely reduced. The time required for the reduction is about an hour and a half for from one to two grammes of ore. It is allowed to cool in the hydrogen, and weighed. The loss of weight gives the oxygen combined with the iron and tin. By treating the matter with nitro-hydrochloric acid, the metallic iron and tin are dissolved ; the gangue of the ore remains unattacked : it may be analysed by the ordinary means.*

Ammonia is added to the solution of tin and iron in nitro-hydrochloric acid, to saturate the acids, and a sufficient excess of hydrosulphate of ammonia to dissolve the sulphuret of tin. It is digested for about 12 hours, and then filtered. The sulphuret of iron, well washed with water charged with hydrosulphate of ammonia, is converted into peroxide of iron by known processes. The sulphuret of tin, in solution in hydrosulphate of ammonia, is precipitated

* When the gangue is a mixture of quartz and fluor spar, it may be quickly analysed, and with tolerable accuracy, by the following process.

The mixture of quartz and fluor spar, well ground and weighed, is fused in a platinum crucible with eight times its weight of carbonates of soda and potassa. The matter is kept in fusion for an hour, and stirred all the time with a platinum spatula ; it is also necessary to observe the ordinary precautions to avoid too much swelling up, owing to the disengagement of the carbonic acid from the alkaline carbonates.

The fused matter is run in a thin layer on a long sheet of platinum, and then digested in water. Without this precaution the disaggregation by water would take place only very slowly. The action of the alkaline carbonates produces alkaline silicates and fluorides, and carbonate of lime. The fused matter also contains the excess of alkaline carbonates.

The water dissolves the excess of alkaline carbonates, the alkaline silicates and fluorides, and leaves as a residue the carbonate of lime resulting from the decomposition of the fluoride of calcium. This carbonate of lime is well washed in warm water, dried at a red heat, and weighed. From its weight is calculated the quantity of fluoride of calcium existing in the mixture. As a verification, the silica in the alkaline solution may be estimated.

I submitted to experiment the mixtures :

	I.	II.	III.
	gr.	gr.	gr.
Fluoride of calcium	0.65	0·50	0·25
Quartz.....	0·35	0·50	0 75

I obtained the following numbers :—

Carbonate of lime..	0·817	0·636	0·318

which correspond to

Fluoride of calcium	0·642	0·494	0·247

These results present a degree of accuracy quite sufficient for the analyses, and especially for calculating the quantities of flux required in the metallurgical treatment of the ores.

M. Pache, formerly a pupil of the Ecole des Mines, has tried the same process, and has obtained as satisfactory results.

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by means of acetic acid, and converted into oxide of tin by roasting with proper precautions.

The weights of the peroxide of iron and binoxide of tin indicate the weight of the metallic iron and tin, rendered attackable by the acids by the action of hydrogen, whilst the loss of weight sustained by the ore, in the hydrogen, gives the oxygen combined with the two metals, and allows of their state of oxidation being determined.

I will now give the numbers which I obtained in the analysis of the tin schlich of Piriac. This schlich contains oxide of tin in small grains, a little oxide of iron, some granite and quartz :—

	gr.
Weight of the schlich submitted to the reductive action of hydrogen	1·1795
Loss of weight, in oxygen removed by the action of hydrogen.....	0·1235
Weight of the gangue insoluble in aqua regia, and containing no tin	0·5650
Iron dissolved in aqua regia.....	0·1310
Tin dissolved in aqua regia.....	0·3624

These numbers give for tin schlich the following composition. For 1 of schlich :—

Iron.....	0·1110
Tin.....	0·3081
Oxygen combined	0·1047
Gangue	0·4700
	1·0028

I may remark that the iron, tin and combined oxygen are in the proportions of

4 equivalents of iron
5 „ „ tin
12 „ „ oxygen.

I shall not seek here to deduce an hypothesis for the chemical formula of native oxide of tin ; I hope soon to analyse several samples of very distinctly crystallised oxide of tin, and to be able to determine the state of combination of the iron and tin with the oxygen. I have mentioned the foregoing analysis only to show the rapidity with which the iron and tin in an ore of tin may be estimated, by commencing with acting on the well-ground ore with hydrogen.

SEPARATION OF OXIDE OF IRON AND OXIDE OF CHROMIUM.

The process ordinarily employed for the separation of oxide of iron and oxide of chromium is the following :—To the hydrochloric solution of the two oxides is added so much tartaric acid that, on saturating the acids by ammonia no precipitate is formed ; the iron is then precipitated in the state of sulphuret by means of hydrosulphate of ammonia : the oxide of chromium remains in solution. To estimate the chrome, the tartaric solution must be evaporated to dryness, the tartaric acid destroyed by roasting, and, finally, the oxide of chromium estimated in the state of sesquioxide, Cr^2O^3.

This process is tedious, and does not lead to a very accurate separation. The following method seems to me much more rapid and perfectly accurate. It is founded on the fact that hydrogen at a red heat easily reduces the oxide of iron, whilst it exerts no action on the oxide of chromium.

The mixture of the two oxides precipitated by ammonia, weighed after calcination, is treated as I have already directed for the mixture of alumina and oxide of iron. After cooling in hydrogen, the matter contains metallic iron and oxide of chromium. The loss of weight is entirely due to the oxygen combined with the iron, and enables us to calculate exactly the quantity of that oxide, and, consequently, the composition of the mixture. As a verification, the matter may be treated by cold weak nitric acid ; the iron alone is dissolved ; the unattacked oxide of chromium may be weighed, and the peroxide of iron precipitated by means of ammonia from its solution in nitric acid. These two estimations are of very remarkable accuracy.

I submitted to experiment

	I.	II.
	gr.	gr.
Oxide of chromium	0·30	0·761
Oxide of iron	0·70	0·749

The losses of weight of these mixtures in hydrogen were :— 0·213 0·230

They correspond to

Peroxide of iron ..	0·705	0·7498

By afterwards treating with weak nitric acid, weighing the undissolved oxide of chrome, and precipitating the oxide of iron with ammonia, I obtained :—

	I.	II.
	gr.	gr.
Oxide of chromium	0·30	0·761
Oxide of iron	0·704	0·750

These numbers suffice to prove that the separation of the two oxides and their estimation are perfectly accurate.

ANALYSIS OF CHROME IRON ORE.

Chrome iron ore may be analysed with great accuracy by the following process.

The ore, after being well ground is placed in a porcelain boat inside a porcelain tube passing horizontally through a reverberatory furnace, and submitted for four hours to a current of dry hydrogen at a bright red heat. All the oxide of iron is reduced.*

* Several chemists have stated that chrome iron ore is only partially attacked by hydrogen ; the reduction is difficult and slow, but

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The loss of weight indicates the oxygen combined with the iron.

The matter treated by hydrogen is put in digestion for twenty-four hours in weak nitric acid at a very gentle heat; this acid dissolves the metallic iron and a trace of lime, but it is without action on the oxide of chromium, silica, alumina and even the lime.

The protoxide of iron is precipitated by ammonia from its nitric solution. The portion not dissolved in the acid is fused in a silver crucible with a mixture of 1 part nitre, 3 parts carbonate of soda, and 3 parts caustic potassa. The mixture is kept well fused for an hour at a dull red heat.

On treating the cooled matter with warm water, it dissolves readily, and without residue; the liquor is of a yellow color.

To the aqueous solution is added sufficient hydrochloric acid to render it distinctly acid; it is then evaporated to dryness with alcohol. It is redissolved in hydrochloric acid; the silica remains undissolved; the acid liquor contains the chlorides of chromium, aluminium and calcium.

After filtration, to separate the silica, the solution is precipitated by ammonia; the precipitate contains alumina, sesquioxide of chromium and a little lime. It is received on a filter, dried and calcined with the ordinary precautions, but taking care to raise the heat to bright redness towards the close of the roasting.

To separate the lime carried away, the precipitate, strongly calcined, is treated with very weak acetic acid without heat; the acetic liquor is combined with the ammoniacal solution; the lime is precipitated with oxalate of ammonia, and it is ascertained whether the liquor contains magnesia.

The recalcined mixture of oxide of chromium and alumina is weighed, and then treated with hydrochloric acid, which dissolves only the alumina; the undissolved oxide of chromium is weighed; the alumina is precipitated with ammonia. When the alumina is accompanied by a little oxide of chromium dissolved by hydrochloric acid, the separation must be made by means of potassa.

I have at present been able to analyse by this process only a sample of chrome iron ore from Baltimore. The ore is in very brilliant crystalline grains: a small portion is attractable by the bar magnet. I separated it before analysing it; it was composed of titaniferous iron.

The analysis gave the following numbers:

	gr.
Weight of chrome iron ore	1·581
Loss of weight by hydrogen	0·144
Peroxide of iron precipitated by ammonia from the nitric solution	0·475

The nitric solution contained besides a trace of lime. It must be remarked that the loss of weight, 0·144 gr., corresponds to the quantity of peroxide of iron, 0·4694 gr., almost equal to that 0·475 gr. precipitated by ammonia, which proves that the iron in this mineral exists in the state of peroxide.

Silica or titanic acid . . . . . 0·035 gr.

I have not been able in this small quantity to distinguish the titanic acid with certainty.

	gr.
Sesquioxide of chromium	1·002
Alumina	0·030
Lime	0·032

The ore does not contain magnesia.

These numbers lead to the following composition for 1 part of ore.—

Peroxide of iron	0·3004
Alumina	0·0196
Lime	0·0202
Silica (titanic acid?)	0·0221
Sesquioxide of chromium	0·6337
	0·9960

I will make only one remark on this composition: the oxygen of the peroxide of iron and of the alumina is very clearly half the oxygen of the oxide of chromium. I intend very shortly to analyse other samples of chrome iron ore, and to ascertain whether this proportion is constant.

Many minerals may easily be analysed by means of dry hydrogen. I hope very soon to be able to complete the foregoing observations, and to determine with some certainty the chemical composition of a certain number of substances difficultly attackable or unattackable by the acids.

in four hours all the iron may be reduced to the metallic state, provided that the ore be well porphyrised.

ON THE CHEMICAL EQUIVALENT OF IRON.*

BY M. E. MAUMENÉ.

SEVERAL analysts have lately made known the results which they have obtained as to this equivalent, whose primitive number has received the greatest modification of any other (from 339·23 to 350). I had occasion to study this subject in 1846. Having had to analyse the wires for the

* *Comptes Rendus*, 21 October, 1850.

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electric telegraph on the Northern Railway, and having found that the iron was extremely pure, I made some experiments to determine the equivalent.

The metal being dissolved in weak aqua regia, I precipitated the oxide with ammonia, I collected it on a filter, and after careful washing with hot water, the filter was placed in a stove at 230° F., then calcined in a platinum crucible. This method gives very good results when the washing has removed all the hydrochlorate of ammonia.

The following are the numbers obtained:

Iron.	Sesquioxide.	Equivalent.
gr.	gr.	
1·482	2·117	350·08
1·452	2·074	350·16
1·3585	1·941	349·82
1 420	2·0285	350·04
1·492	2·1315	349·96
1·554	2·220	350·00
	Mean	350·01

SEPARATION OF SULPHATE OF LEAD FROM SULPHATE OF BARYTA.

BY DAVID ZENNER.

THE separation of these sulphates from each other by fusion with carbonate of soda and potassa is a very troublesome operation, as the fusion must be continued for a long time at a high temperature. This very frequently endangers silver and platinum crucibles, and the alkalis act on porcelain when crucibles of that material are used. I have also found that the fused mass, when digested with water to remove the alkalis, always dissolve a considerable portion of the oxide of lead formed. But all these disadvantages may be avoided by the use of the alkaline nitrates instead of the carbonates. They melt at a considerably lower temperature, at which they are capable of decomposing the sulphate of lead, forming sulphate of the alkali and nitrate of lead, which latter being decomposed at about the point of fusion of the nitre leaves oxide of lead, with evolution of oxygen and nitrous gas. I commonly weigh the mixed sulphates into a porcelain crucible, and add sufficient nitre to cover them with a clear layer when in fusion, about 3 to 4 times by weight. The covered crucible is then heated to a temperature just sufficient to melt the nitre, until no more nitrous vapors are disengaged, and then raised to a dull red heat, at which it is kept for a few minutes only. After cooling, the alkalis are dissolved out with warm water, and washed. The matter insoluble in water is now digested with dilute nitric acid, which will dissolve all the oxide of lead, leaving the sulphate of baryta insoluble, which is collected on a filter, washed and weighed. The sulphate of lead may be ascertained by the difference in weight, or obtained by precipitation with sulphuric acid and alcohol, or by any other convenient method from the nitric solution The porcelain crucible used in this operation will be found unattacked, and the alkaline solution, containing only neutral sulphates and nitrates, is unable to dissolve any oxide of lead.

This method will be found very easy in the analysis of certain mixtures sold as "cheap white lead," containing sometimes chalk besides the two substances mentioned.

METHOD OF ANALYSIS FOR ORES CONTAINING LEAD COMBINED WITH SULPHUR.

BY DAVID ZENNER.

THE methods hitherto used in the analysis of galena have many objections, which I will briefly enumerate. The application of a stream of dry chlorine gas is very troublesome and the vapors disagreeable. When strong hydrochloric acid is used, the process is rather slow and uncertain; this process is rarely used. By dissolving the ore in dilute nitric acid, it is difficult to prevent the formation of some sulphate of lead, which mixes with the other insoluble matters contained in ores. The two latter methods also require a separate operation for the estimation of the sulphur; and on deflagrating the ore with a mixture of carbonate of soda and nitrate of potassa it is difficult to avoid a loss from spitting, as the lid must be lifted when a new portion of the mixture has to be introduced. In all these methods the difficulties increase when large quantities of the ore have to be operated upon.

The following process I find under all circumstances to answer very well, and to possess many advantages over those above mentioned. The finely pulverised ore is oxidised, by means of fuming nitric acid, in a large porcelain crucible, covered with a lid or watch-glass, having a small hole in it: after the violent action has ceased the vessel is placed on the sand-bath to complete the oxidation, and to evaporate to dryness. I then add as much pure nitre as will, after fusion, cover the mass in the crucible entirely, or about 3 to 4 times the weight of ore, and heat gradually to fusion, and incipient red heat, as described in the

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preceding paper; but when the ore contains arsenic a little carbonate of soda must be added after the disengagement of the nitrous vapors has ceased and before the temperature is increased.

After cooling dissolve and wash the fused mass with warm water. The filtrate contains the sulphuric and arsenic acids resulting from the sulphur and arsenic. The matter insoluble in water is treated with dilute nitric or acetic acid, in order to dissolve out the metallic oxides. The residue insoluble in the acid may contain silica, sulphate of baryta, antimonic acid, and, but rarely, gold. The different substances in the two solutions and insoluble matter may be separated and estimated by known methods.

I have only to add a few precautions: when the ore contains carbonate of lime or baryta, they should first be removed with acetic or very dilute hydrochloric acid, before the oxidation with nitric acid. When the ore is likely to contain any silica in chemical combination which might be freed by the nitric acid, it should be repeatedly evaporated with some nitric acid to insure its insolubility, and none will afterwards be dissolved by the nitre in fusion; and, lastly, when it contains antimony, the water for washing should be gradually replaced by alcohol, and the lixiviation finished therewith, as recommended by Professor Rose.

ON THE COMPOSITION OF SOME NATURAL ORGANIC BASES.*

BY DR. A. VON PLANTA.

THE researches of many chemists have, during the last few years, given a great impulse to studies relating to the composition of the vegetable alkalis. In this highly-cultivated ground there is, however, still something to do. The study of some natural bases, such as atropine, daturine, and aconitine, have been rather neglected, and the author thought that it might be interesting to make some researches on the composition of these bases. The following are the results of his experiments.

The atropine which he analysed had been prepared by M. Merck, of Darmsdadt; it was in small fine needles, unalterable by air and heavier than water. One part of atropine required 300 parts of water to dissolve it at the ordinary temperature. Alcohol dissolves it in all proportions, ether dissolves it with less ease.

At 194° atropine melts into a colorless, transparent liquid, which cools into a brittle mass, in which, after long fusion, agglomerations of small needles grouped in stars may often be observed. At 284° it partly volatilises, so that it becomes almost entirely decomposed. Heated on a sheet of platinum it melts easily, puffs up, emitting white sparks, then inflames, burns with a very brilliant flame and leaves a bright black charcoal.

The aqueous solution of atropine has a powerful alkaline reaction. This base combined with the alkalis forms neutral and uncrystallisable salts. Evaporated in vacuo these salts dry into a colorless syrup. They dissolve readily in water and alcohol, less easily in ether. The hydrochlorate of atropine behaves in the following manner with reagents:—

Potassa, ammonia, and carbonate of potassa give, in very concentrated solutions of this salt, pulverulent precipitates which are easily soluble in an excess of the reagent.

Carbonate of ammonia, bicarbonate of soda, and phosphate of soda give no precipitate. Chloride of gold gives a yellow crystalline precipitate, difficultly soluble in hydrochloric acid. Chloride of platinum forms a pulverulent precipitate which easily agglutinates into a resinous mass, and which dissolves in hydrochloric acid. Chloride of mercury only precipitates a very concentrated solution of hydrochlorate of atropine. Double iodide of mercury and potassium forms a thick, white precipitate, which agglutinates strongly on the addition of hydrochloric acid. Iodide of potassium and sulphocyanide of potassium cause no precipitate. Tincture of iodine causes a brown precipitate in the solution of hydrochlorate of atropine. Iodic acid does not color it; tincture of gall nuts and infusion of gall nuts only precipitate it after the addition of hydrochloric acid.

Picric acid forms a yellow precipitate, nitric acid causes no alteration.

Dr. Planta has analysed free atropine and the double chloride of atropine and gold. His analyses give the following as the formula for this salt:—

$$C^{34}H^{23}NO^{6}, HCl+AuCl^{3}.$$

The composition of free atropine is therefore expressed by the formula:—

$$C^{34}H^{23}NO^{6}.$$

This formula has besides been verified by another experiment in which the author has determined the amount of hydrochloric acid gas absorbed by a given quantity of atropine. He found that 100 parts of atropine absorb 13·85 parts of hydrochloric gas, which accords very well with the

* *Annalen der Chemie und Pharmacie.*

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equivalents deduced from the analysis of the salt of gold. Dr. Planta has moreover determined the exact quantity of sulphuric acid necessary to saturate a given weight of atropine. The equivalent calculated from this last experiment accords equally well with the theoretic equivalent.

DATURINE.

The daturine extracted in 1833, by MM. Geiger and Hesse, from the *datura stramonium* is in the form of small brilliant needles united in tufts. It is colorless, unalterable by the air, and denser than water.

Dr. Von Planta has made the interesting remark that by the whole of its properties and by its composition, this alkaloïd is confounded with atropine. The double chloride of daturine and gold may be obtained as a crystalline mass of a beautiful golden yellow color.

Its composition is expressed by the formula.—

$$C^{34}H^{23}NO^{6}, HCl + AuCl^{3}.$$

ACONITINE.

The discovery of this base is likewise due to MM. Geiger and Hesse, who, in 1833, extracted it from the *Aconitum Napellus*. Before investigating the properties and composition of this base, Dr. Von Planta purified that obtained in commerce by the following process. After dissolving it in ether he evaporated the ethereal liquid; the syrupy residue was redissolved in absolute alcohol, and this solution was gradually poured into cold water, which was continually stirred. He thus obtained a dense and flocculent precipitate, which was pressed between paper and dried in vacuo.

Aconitine thus prepared is a colorless and inodorous powder, quite unchangeable by the atmosphere. When heated on a sheet of platinum it fuses readily, takes fire, leaving a residue of charcoal, which is easily incinerated. It is impossible to partially volatilise it in the same manner as atropine. Aconitine is heavier than water and dissolves very slowly in this liquid. It is very readily soluble in alcohol, less easily in ether.

It melts at 176° F., and on cooling becomes a vitreous and transparent mass. At 248° it begins to turn brown.

It possesses a powerful alkaline reaction, and completely saturates the acids. Its salts are uncrystallisable. Hydrochlorate of aconitine has the following reactions:—

Potassa, ammonia, and carbonate of potassa form in it a white, flocculent precipitate of aconitine, but little soluble in an excess of the reagent. Carbonate of ammonia, bicarbonate of soda and phosphate of soda form no precipitate. Chloride of gold gives a whitish yellow precipitate, difficultly soluble in hydrochloric acid. With chloride of mercury and sulphocyanide of potassium, caseous white precipitates are obtained; with tincture of iodine a precipitate of the color of kermes. Tincture of gall nuts and gallic acid precipitate aconitine on the addition of a drop of hydrochloric acid. Picric acid forms in it a dense sulphur yellow precipitate.

The analyses of the author have led him to the formula,

$$C^{60}H^{47}NO^{15}.$$

The double hydrochlorate of aconitine and gold contains:—

$$C^{60}H^{47}NO^{14}, HCl + AuCl^{3} + H^{2}O^{2}.$$

The author has found that 0·2970 gr. of this alkaloïd absorbed at 212°, 0·0460 of hydrochloric gas, which corresponds to 13·41 per cent. of hydrochloric acid in 100 parts of the hydrochloric compound represented by the formula

$$C^{60}H^{47}NO^{14}, 2HCl.$$

ON THE PRESENCE OF CASEÏNE IN SOLUTION IN THE BLOOD OF WOMEN DURING LACTATION.*

BY MM. NATALIS GUILLOT AND FELIX LEBLANC.

THE presence of a substance analogous to coagulated caseïne has already been pointed out by M. Dumas in diseased blood. More recently, MM. Dumas and Cahours published, in their memoir on proteïc matters, the analysis of a product extracted from blood, and possessing, if not all the properties, at any rate the composition of caseïne.

M. Stas has lately discovered that the placentar blood in women contained, in solution, a considerable amount of caseïne.

The interest which would attach to the demonstration of the existence of caseïne, in a state of solution, in the normal blood of women, or of females during lactation, has been long understood. M. Dumas sought, but without success, to prove the presence of this matter in sheep during lactation.

No one, as far as we are aware, having shown that caseïne exists, in solution, in the blood of nursing women, we have thought ourselves justified in laying before the Academy, the facts which we have just proved on this subject.

We have examined the blood from two nurses in the height of lactation.

The serum of these various bloods, de-

* *Comptes Rendus*, October 7, 1850.

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prived of albumen by coagulation by heat, and filtered, furnished an abundant white precipitate when boiled with a few drops of acetic acid.

We recognised in the solution all the characters of caseïne. The quantity of this product appeared to us to be in proportion with a diminution in the amount of albumen.*

By operating in the same manner on the blood of new-born infants, we could find no sensible trace of caseïne.

The blood of men and women, examined in the same manner, gave a very slight precipitate which redissolved on the addition of a few drops of carbonate of soda, but much less abundant, and differing in appearance from the precipitate furnished by the blood of nurses. The latter only could be collected.

We shall shortly make known some new experiments which we have undertaken, causing them to follow analytical results.

NEW PROCESS FOR SEPARATING IRON FROM MANGANESE.†

BY M. O. HENRY.

TAKE the liquid supposed to contain the iron and manganese, etc., pass through it a slight current of chlorine to peroxidise these metals, then add pure potassa in excess, collect the precipitate, warm it slightly with the potassa, so as to dissolve all the alumina. Wash it, always in the same vessel, then add to the deposit pure sulphuric acid and sugar; a colorless liquid is thus quickly obtained, which must be filtered through cotton, to isolate the sulphate of lime, should there be any in it; add to the liquid pure potassa or ammonia, etc., still leaving a trace of acidity. Heat it slightly in an open vessel, almost all the iron will be deposited as sesquioxide, or its salt is peroxidised. Filter again, and add, with great care, a dilute solution of prussiate of potassa; this is dropped in until there is a blue or blueish precipitate, then stop, filter and add to the new clear liquid a slight excess of the same prussiate. This time there will be a *flesh-colored* deposit, this is prussiate of manganese. This is collected by standing (it takes place slowly as the deposit is voluminous and highly hydrated).

When entirely collected on a small piece of cotton, dry and weigh it, but it is preferable to heat it with pure potassa in the air, or to *chloridise* it slightly; this operation gives a brownish precipitate, passing to a *brown black*, and constituting the sesquioxide of manganese, which will be easily weighed after washing.

* This fact appeared to us the more interesting, as the caseïne of the milk of women habitually exhibits certain peculiar characteristics, especially a resistance to coagulation by the agents usually employed for this purpose.

† *Journal de Chimie Médicale*, October, 1850.

ON THE PRESENCE OF IODINE IN FRESH WATER, AND IN TERRESTIAL PLANTS.*

(Extract of a letter from M. Marchand.)

"I have just read the conclusions of a memoir by M. Chatin, on the existence of iodine in fresh water and in terrestial plants.

"Having obtained some of the results mentioned by M. Chatin, before the publication of his memoir, I made a note of the conclusions at which I had arrived on this same subject, and, enclosing it in a sealed packet, deposited it in the Academy on the 21st of last July.

"The results are described in this note under the following seven heads:—

"1st. All natural waters, except under certain circumstances, which I will mention, contain iodine and bromine;

"2nd. All waters contain lithia;

"3rd. All, when they take their rise in chalky soils or calcareous earth, contain iron;

"4th. The origin of the iodine and bromine in water is chiefly from these principles being removed from the sea, by the vapors or aqueous particles which incessantly escape from it, and which, being carried over the earth, fall on its surface as rain, snow or hail;

"Rain and snow waters usually contain an appreciable proportion of iodine and bromine.

"5th. In well wooded countries, iodine and bromine may disappear from the waters which hold them in solution, in passing into the saline state, under the influence of the vital forces among the mineral principles fixed by the vegetables.

"The ashes of the greater part of our forest trees contain iodine.

"6th. The determining causes of goitre and cretinism will not be found in the existence of carbonate of magnesia in the water used by these unfortunate people for their alimentary requirements.

* *Comptes Rendus*, September 30, 1850.

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"7th. The determining cause of these maladies would rather exist in the absence of iodine and bromine from the number of the constituent principles of these waters."

As the note containing these propositions likewise contains others which the author does not at present think proper to publish, he requests that it may not be opened as yet. As soon as his work is finished and ready for submission to the judgement of the Academy, M. Marchand will hasten to apply for the opening of his packet.

ON THE MINERALS OF THE AURIFEROUS DISTRICTS OF WICKLOW.*

BY WILLIAM MALLET, ESQ.

THE circumstances attending the original discovery of native gold in the beds of some of the streams of the county of Wicklow, have been already often detailed, and will therefore need but a brief repetition. The source of the auriferous streams is the mountain Croghan Kinshela, whose summit forms a portion of the boundary between the counties of Wicklow and Wexford. The stream from which most of the gold has been obtained rises on the north-east side of this mountain, and flowing down one of the glens with which that part of the country is intersected in almost every direction, joins the Aughrim river a little above the confluence of the latter stream with the Avonmore. It receives several smaller streams at different parts of its course, in all of which *some* gold appears to have been found, though in general in such small quantity as not to repay the cost of its extraction.

Although this part of the country, since it has been known to be auriferous, has been an object of some attraction to mineralogists, but little attention seems to have been directed to the other minerals which are to be found accompanying the gold in the alluvial deposits. These, however, are interesting, not only from their number and variety, but also from the occurrence among them of some of the rarer species, which do not appear to have been noticed in any other locality in Ireland. The following minerals were obtained from a considerable mass of sand and gravel taken from various parts of the bed of the principal stream :—

Gold.	Copper pyrites.
Platina.	Galena.
Tinstone.	Sulphuret of molybdenum.
Magnetic oxide of iron.	Sapphire.
Micaceous iron.	Topax.
Red iron ochre.	Zircon.
Hydrous peroxide of iron.	Garnet (two varieties).
Common clay ironstone.	Quartz.
Iron pyrites.	Prase.
Titaniferous iron.	Augite.
Wolfram.	Chlorite.
Oxide of manganese.	Felspar.
	Mica.

The author has since observed, in addition to those here mentioned, arsenical iron, in small fragments, and also spinelle. The latter occurs in very small grains along with the second variety of garnet, from which it is readily distinguished by its peculiar purplish-red color.

GOLD.

This mineral occurs here in probably its most beautiful form. It possesses the true golden yellow color and metallic lustre which characterise the metal, and owing to the attrition to which it has been subjected, generally presents a beautifully brilliant surface. It occurs in grains of all sizes, from the smallest spangle up to a mass weighing twenty-two ounces, the largest hitherto found. The specific gravity of some small grains Mr. Mallett found to be 16·342. The analysis of these grains gave—

Gold	92·32
Silver	6·17
Iron	·78
	99·27

This is equivalent, (neglecting the iron) to 8¼ atoms of gold and 1 of silver.

PLATINA.

Mixed with the gold are some very small flattened grains of a white color and metallic lustre, which, as far as their minute size permitted an examination, appear to present all the characters of platina. They are infusible before the blowpipe, and insoluble in nitric acid, but dissolve in aqua-regia. Their occurrence intermixed with the gold when all other minerals have been washed off, is a proof of their high specific gravity.

TINSTONE.

The occurrence of this mineral in the sand is mentioned by Weaver in his reports on the gold-stream-works, but he does not seem to have been at all aware of the large quantities in which it exists. From the

* Transactions of the Geological Society of Dublin.

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comparatively small portion* of sand which the author had an opportunity of examining, he obtained about 3½ pounds of stream tin; a portion of which being reduced, yielded an ingot, which, when refined by a second fusion, is hardly inferior to the finest grain tin.† Should this mineral be found in the mass of the sand in a quantity at all approaching that in which it existed in the specimen from which this was obtained, it would probably richly repay the labour and expense of its collection and smelting. From the small quantity in which other minerals of high specific gravity exist in the sand, and the constant supply of water, very little difficulty would be experienced in separating it from the rest of the sand; and the almost total abstinence of arsenic and lead would render it extremely easy to obtain from it metallic tin of the very first quality. The mineral itself occurs in grains varying in size from fine sand up to pebbles of half an inch in diameter, and for the most part of a dark brown color, with some fragments of various tints of yellow and red; some presenting the peculiar appearance to which the name "wood tin" has been given. All these varieties are slightly translucent, some of them highly so. Many of them present distinct traces of the obtuse octohedron, the same with a short four-sided prism interposed between the two pyramids, and the latter of these with various truncations of its angles and edges. The specific gravity of some picked crystals was 6·753. A careful analysis of this tinstone gave as its constituents—

Peroxide of tin	95·26
Peroxide of iron	2·41
Silica	·84
	98·51

The greater number of minerals here enumerated are mentioned by Mr. Weaver in his reports to Government on the district, and which are to be found in the Transactions of the Royal Dublin Society; but some of them, the author believes, have not been noticed before, at least he has seen no published account of the occurrence in this locality of platina, titanic iron, sulphuret of molybdenum, topaz, zircon, the small manganesian garnets, or augite. Hence it seemed interesting, while noticing these, to collect into a uniform and as far as possible complete list, all the scattered notices of the mineral wealth of this particular district, which are to be found in Mr. Weaver's papers already referred to, and elsewhere.

The principal point, however, with respect to the examination of these minerals, which appears to merit further and more particular attention, is the fact of the existence of tinstone in such considerable quantity in these auriferous streams;—a fact which would seem to indicate the probable existence somewhere in the surrounding district, of masses of the ore of this valuable metal of great extent, and possibly forming the continuation on this side of the Channel, of those vast deposits which have contributed to furnish occupation and support to the inhabitants of Cornwall for more than two thousand years.

* The exact weight of the specimen examined the author does not know, but thinks it certainly did not exceed 150 lbs.

† The specimen smelted in this experiment yielded about 61 per cent. of tin; but more would be obtained on the great scale, as in this case no pains were taken to extract the tin remaining in the scoriæ.

ON THE COLORATION OF VEGETABLES.*

BY M. MOROT.

CHLOROPHYLLE being but little known, the following results extracted from a great work just published by M. Morot, will throw a new light on this difficult subject:

"We always find a mixture of chlorophylle and fatty matter in green plants, we find fatty matter without chlorophylle, in plants which have not yet been subjected to the influence of light, and in those which have ceased to be green and have assumed the autumnal tints; we thus see that the fatty matters perform their part during the whole life of the vegetable, whereas that of chlorophylle is confined to its life in the light, and even then, during only a portion of its duration.

"The fact, discovered by Marquart, and elucidated by M. Mulder, of the constant mixture of fatty matter and chlorophylle, is fully confirmed by the results that I have obtained to represent the fatty extract of the acacia, mallow, and annual mercury.

	Acacia.	Mallow.	Mercury.
Carbon	76·18	76·34	76·64
Hydrogen ...	11·08	11·25	11·15
Oxygen	12·74	12·41	12·21

"The numbers relative to the mercury appear in the case of the carbon to differ a little from the others; but it must be remarked that they are the results of a smaller number of analyses, and the weight of the fatty matters employed was less, which

* *Repertoire de Pharmacie*, October, 1850.

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tends to augment the chances of error; when other analyses were made afterwards of the same substance saponified, we found numbers between those of the mallow and acacia. The following will be the formula in equivalents the nearest approaching to these numbers:—

C^8	76·20
H^7	11·11
O	12·69

M. Mulder found for the analagous substance $C^{15}H^{15}O$; the relation which he sought to establish between this substance and starch, when water is introduced, agrees exactly with the formula resulting from my analyses. We have in fact:— $2C^{15}H^{10}O^{10}+HO=3C^6H^7O+18O$, and it is evident that if we add one equivalent of water to two equivalents of starch, we deduce therefrom three equivalents of fatty matter and eighteen equivalents of oxygen. The fact of the transformation of starch into fatty matter in vegetable tissues, may be considered to be accompanied by an immense disengagement of oxygen; and if it can be shown that such a transformation does really take place, we shall have one of the most abundant sources of the oxygen disengaged by plants.

The numbers resulting from the analyses of fatty matters, extracted from graminaceous plants blanched and green, were not sufficiently clear for us to be able to draw any certain results from them. We see, on the one hand, that an analysis of wheat, cultivated under ordinary circumstances, gives the numbers

Carbon	75·82
Hydrogen.....	11·15
Oxygen	13·03

which agree completely with the preceding. On the other hand oats and green wheat, cultivated under artificial circumstances, after a development of some days, give us the following numbers:—

	Wheat.	Oats.
Carbon.....	76·21	76·20
Hydrogen	11·71	11·52
Oxygen.....	12·08	12·28

which seem to indicate a hydratation of the fatty matter found in green plants. The analyses of the fatty matter of weakly oats, although furnishing slightly varying numbers,—

	I.	II.	III.
Carbon	75·38	76·20	74·87
Hydrogen....	11·45	11·75	11·38
Oxygen	13·17	12·05	13·75

agree in proving an excess of hydrogen, and those belonging to the second series agree exactly with the results of the analyses of green plants. But it is here desired to resolve this important question:—is the fatty matter modified by the influence of light, and does it preserve the same composition before and after the development of the chlorophylle? This question will require more experiments before attaining to a definitive solution, and to conquer the difficulty it will be necessary to procure the fatty matter of the weakly plants always in the same state. At the same time that I attend to this subject I shall pursue that which I have already commenced; the comparison of the fatty matter in the grains and the plants proceeding from them.

The fat extracted from the leaves of the acacia and vine when yellow seem to indicate dishydratation, when the results are compared with those furnished by green plants. In fact, the fatty matter of the latter may be represented by the formula $C^{72}H^{63}O^9$, and that of yellow vine leaves by $C^{72}H^{61}O^7$, which differs from the former by only two equivalents of water. But for the vine chiefly, it is necessary to assure ourselves that the difference is in the physiological state, and not in the peculiar nature of the plant.

If, now, we turn to chlorophylle, we find an extremely curious fact, which I am not aware has hitherto been pointed out in science. We see that the chlorophylle of the mallow and that of the *Lolium perennium* give the following numbers:—

	Mallow.	Lolium.
Carbon	69·33	70·05
Hydrogen.....	6·57	6·67
Nitrogen	9.11	8·96
Oxygen	14·99	14·32

Now these numbers are well represented by the formula.

C^{18}	69·23
H^{10}	6·41
N	8·98
O^3	15·38

When it is considered that the fatty matter is the most probable cause of impurity it must be allowed that the numbers found may be reconciled with those resulting from the adoption of the formula which I have just given. Now, when we try to unite this formula to those of the substances which play an important part in the vegetable kingdom, we shall find that 3 equivalents of starch augmented by 2 equivalents of ammonia, give 2 equivalents of chlorophylle, 16 equivalents of water and 8 equivalents of oxygen. They are, in fact, identical, $3C^{12}H^{10}O^{10}+2NH^3=C^{18}H^{10}NO^3+16HO+8O$, so that chlorophylle appears *to be formed by the union of amylaceous and ammoniacal matters, under the influence of diffused light, and its*

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formation is accompanied by a disengagement of water and oxygen.

Thus the fundamental fact in the physiology of plants, the disengagement of oxygen, is found coincident with the development of chlorophylle; it is not *because they are green that plants disengage oxygen, but because they become so.* A great number of plants are constantly sheltered from the influence of direct solar light, and are, notwithstanding, as green as those near them which are subjected to this influence; they are as able as these others to disengage oxygen, according to the principle that I have just mentioned. But the most prominent fact of these results is the intervention of nitrogen in the development of the green matter. This body, which appears to act under the form of ammonia, likewise acts in the manner which is considered usual to it by MM. Dumas and Boussingault, in their clever researches on the chemical statics of organised beings.

Berzelius, and after him M. Mulder, have assimilated chlorophylle to indigo, and considered that it oxidises as it becomes green. This hypothesis appears to me completely inadmissible, because I have proved that in faded plants, no nitrogenous substance accompanies the fatty matter. When the leaves cease to be green, not only do they cease to contain chlorophylle, but no nitrogenous substance accompanies the remaining fatty matter.

When I have, by further experiments, established the definitive composition of chlorophylle, I shall have a valuable means of following, step by step, the development of this substance in plants. By operating on the same plant, at various ages, I shall be able to state exactly how much nitrogen enters into the mixture of chlorophylle and fatty matter furnished by it, and the results which I shall obtain will enable me to fix the proportions in which these two associated substances vary. All the circumstances which influence the quantity of chlorophylle developed in a vegetable, may thus be appreciated, without being obliged to isolate this substance, the preparation of which is so difficult. When we enquire in what class of organic substances chlorophylle should be included, we observe that its composition is in every respect similar to the vegetable bases; its solution in acids, with which it forms green salts, from which water displaces it, confirms this opinion. In plants it is found dissolved in the fat which accompanies it.

There exists a very simple relation between the formulæ representing chlorophylle and the fatty matter:—3 equivalents of fat, plus one equivalent of ammonia, form one equivalent of chlorophylle, plus one of carburetted hydrogen:—

$$3C^{8}H^{7}O+NH^{3}=C^{18}H^{10}NO^{3}+C^{6}H^{14}.$$

I have only one other result, in some measure isolated, of the coloring matter of yellow flowers; we see by the composition of the fatty matter extracted from the *Narcissus pseudo-Narcissus*,

Carbon	75·48
Hydrogen	10·91
Oxygen	13·61

that this substance is very similar to all those met with in green leaves; its composition is above all like that which is acquired by the fatty matter of green leaves when oxidising in the air. Does there then exist in these flowers a peculiar yellow coloring matter mixed with the fat, or rather is the fat itself the coloring agent? It is at present impossible for me to say. I am as ignorant with respect to faded leaves, because the solutions in hydrochloric acid employed in the treatment of the fatty matters have not furnished me a sufficient quantity of the substances to determine their nature.

There is a great analogy between the colors of blanched leaves and those of yellow flowers; nevertheless, what an immense difference is there in the manner in which they behave in the light! Blanched leaves soon take a green color, the others on the contrary from a greenish yellow become of a more intense yellow. But that is a question which touches too nearly on the mysteries of organic life for it to be of any use to agitate it prematurely.

The coloring matter of blue flowers is, as has long been known, of quite a different nature from that of yellow flowers; to understand its composition it will be necessary, in the first place, to obtain it always alike from one plant, and then to see if it varies in one plant from another, which is not very probable. The varieties of tint are more likely to proceed from the mode of grouping the cellules containing the coloring matter, and the varying proportions of wax which accompany it. I shall pursue my researches on this subject, for the purpose of discovering whether the blue matter is really nitrogenous, and whether its composition is connected with that of chlorophylle.

I have not dwelt on the peculiar substances which I have met with in alcoholic solutions with the mixture of fatty matter and chlorophylle; these are details in some degree foreign to the general subject which I had in view; I have therefore limited myself to

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mentioning their presence, and giving the results of some analyses where I have obtained them in sufficient quantity. I shall merely remark that, in two nearly similar plants, wheat and oats, I found in one a substance which was wanting in the other, or which existed in it in very minute proportions. I mean that white pulverulent matter, of which I have given three analyses agreeing with the formula:—$C^{30}H^{30}O^{17}$.

One curious fact is the simple relation which exists between all these matters and amylaceous substances.

I may likewise mention the wax extracted from corn flowers, the constitution of which resembles that of the wax of the palm tree.

ON THE HYDRATES OF SULPHURIC ACID.*

BY M. V. A. JACQUELAIN.

1st. THERE were at least ten different opinions on the freezing point of the acid with one or two equivalents of water; whilst setting them right, the author makes known the precautions necessary for the determination of the freezing point of viscid liquids, which explains these former contradictions: in the course of these experiments, M. Jacquelain has been led to the discovery of the relation between the crystallisation of a saturated solution of sulphate of soda at 212° F., and the phenomenon of the congelation of monohydrated sulphuric acid, bihydrate on one part, and, on the other, with the facts observed by M. Dony on the cohesion of liquids;

2nd. The author then prepared, with great care, sulphuric acid with 1, 2, 3, 4, 5 and 6 equivalents of water, he took their density to compare them with those of the same hydrates, obtained by slow combination *in vacuo*;

3rd. Their resistance to congelation at a cold of −4° F. and −40° F., shows that all these products are real combinations;

4th. M. Jacquelain has discovered by synthesis and analysis, a new compound of anhydrous and hydrated sulphuric acid; the combinations obtained by synthesis or analysed in this memoir, are:—

$4(SO^3), 3(HO)$; $SO^3, 3(HO)$; $SO^3, 4(HO)$; $SO^3, 5(HO)$; $SO^3, 6(HO)$.

ON ANHYDROUS AND CRYSTALLISED IODIC ACID.*

BY M. V. A. JACQUELAIN.

THE author both practically and theoretically examines the value of divers known processes for the preparation of iodic acid. The facts mentioned in this memoir may be thus condensed:—

1st. The action of chlorine on iodine and chlorate of potassa requires such precise and minute manipulation that it is impossible for these processes to be used in manufacture;

2nd. That of dry hypochloric gas and iodine is too long and very expensive;

3rd. The use of nitric acid at 1·5 and of iodine gives immediately, without much expense or trouble, a great deal of very pure, anhydrous and crystallised iodic acid, with which all the hydrates of M. Millon may be produced;

4th. The action attributed to small quantities of nitric acid on chlorate of potassa is wrong so far as regards the production of iodic acid;

5th. In reacting on a solution of iodate of baryta with sulphurous acid, no sulphate of baryta is produced;

6th. in the presence of certain proportions of acid iodate of baryta and sulphuric acid, the latter may escape the characteristic action of the baryta;

7th. Iodic acid colors protosulphate of iron in pure and concentrated sulphuric acid, in a similar manner to nitric acid and the nitrates;

8th. The equivalent of iodine is 1570, (O=100 : 125 O=8) instead of the old numbers of 1579 and 1586 (O=100).

ON MINIUM.*

BY M. V. A. JACQUELAIN.

IN this work, the author describes in detail the divers modes of action of acetic acid on minium, and mentions the formation of acetate of minium and acetate of binoxide of lead. This last is, according to analysis, represented by $3(C^4H^3O^3)\,Pb\,O^2$, and its decomposition, under the influence of heat, is explained by the production of acetone, of coumarine, by the reduction of the oxide of lead and liberation of a little acetic acid, carbonic acid and water. The study of acetate of minium, in contact with ammonia in solution, having led to the discovery of the sesquioxide of lead, Pb^2O^3, we arrive at very simple conclusions as to the generation of the oxides of lead,—conclusions which apparently confirm the experiments of indirect synthesis undertaken on minium. Thence, the author has been led to examine the composition of the miniums and orange

* *Comptes Rendus*, 28 October, 1850.
† Ibid.

* *Comptes Rendus*, 28 October, 1850.

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miniums of commerce, for which he gives an exact and quick method of analysis, and a process for the analysis of very poor argentiferous litharges.

ON DULCINE.*

BY M. V. A. JACQUELAIN.

In this work, M. Jacquelain has particularly applied himself to define dulcine properly.

This study embraces:—

1st. The action of dilute sulphuric acid, of monohydrated acid, of acid of Nordhausen, whence result two new acids, forming with baryta neutral and soluble salts;

2nd. The action of potassa, lime, and potassa-lime, which convert it into butyrate, oxalate, alkaline carbonate, with a very great quantity of hydrogen;

3rd. The action of nitric acid, which produces acids, composing, with baryta, sparingly soluble salts;

4th. The action of chlorine, which leads finally to an acid forming with baryta a neutral salt, uncrystallisable and viscid;

5th. The elementary analysis leads to the formula

$$C^{10}H^{12}O^{10}.$$

TO OBTAIN THE METALLIC LEAD FROM SULPHATE OF LEAD.†

BY M. SCHNEDERMANN.

There are several processes in the arts in which sulphate of lead is produced as a residuum, amongst other processes may be mentioned that of the manufacture of acetate of alumina for the use of calico printers. For this purpose a solution of sulphate of alumina is mixed with a solution of acetate of lead, and the resulting decomposition gives acetate of alumina, in a fluid state, and sulphate of lead, precipitated in the form of an insoluble sulphate. M. Schnedermann's process for reducing the sulphate, and obtaining the metallic lead which it contains, is as follows. He makes an intimate mixture of sulphate of lead, chalk, charcoal, and fluate of lime, and submits the mixture to a white heat. Sulphate of lime, and carbonate of lime is first formed, which is subsequently reduced by the charcoal. As the sulphate of lime is infusible at the temperature employed, the lead does not unite together in a button, but remains in a divided state, scattered through the mass, unless the precaution of adding fluorspar has been taken. This last-named substance possesses the property of rendering the sulphate of lime fusible, thus allowing the particles of metallic lead to unite in one mass at the bottom of the crucible. The proportions employed are the following:—Sulphate of lead, dried in the air, 8 parts; chalk, 5½ parts; charcoal, 1 to 1¼ parts; fluate of lime, 3 parts. After keeping the whole at a white heat for one hour, in a Hessian crucible, M. Schnedermann obtained a button of metallic lead perfectly free from sulphur. The porous scoriæ contain a few particles of the metal; these may be separated from the scoriæ by washing and decantation, and thus the whole of the lead contained in the sulphate may be recovered.

* *Comptes Rendus*, 28 October, 1850.
† *Patent Journal.*

ON A MEANS OF MAINTAINING IN A CONSTANT STATE OF SATURATION THE COPPER SOLUTIONS EMPLOYED IN THE ELECTROTYPE PROCESS, ON THE LARGE SCALE.*

BY M. PHILLIPP.

An essential condition of obtaining a good deposit of copper, is the employment of a solution of sulphate of copper, as saturated as possible. The means which have been adopted to secure this saturation are that of suspending small bags of sulphate in the solution,—but owing to the great quantity of sulphuric acid set at liberty by the deposition of the copper, the object sought for is but imperfectly accomplished by these means. It has been the custom to neutralise this free acid by means of chalk; M. Philipp suggests the substitution of carbonate of copper for sulphate, and having himself tried the experiment, both on the small and large scale, he has fully satisfied himself of the value of the new process. To prepare a carbonate of copper, a solution of carbonate of soda is added to a solution of sulphate of copper, carbonate of copper is precipitated, and sulphate of soda remains in solution. The expense is somewhat more, but this is more than compensated for by the advantages obtained.

APPLICATION OF SUPERHEATED STEAM TO THE DISTILLATION OF MERCURY.†

BY M. VIOLETTE.

M. Violette, who is well known from his researches on the application of superheated steam to the carbonisation of wood, &c., presented a communication to the Academy,

* *Patent Journal.* † Ibid.

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relative to the distillation of mercury by superheated steam, in which he pointed out the following advantages as arising from the employment of the new process:—1. Rendering the process less dangerous. 2. Great economy of labor, one workman being able, by the new process, to work an apparatus charged with 1,000 kilogrammes (one ton) of amalgam. 3. Economy of fuel. 4. Great saving of mercury in the treatment of silver ores. 5. Less danger to public health from the mercurial vapors.

CHEMICAL EXAMINATION OF THE REFUSE LIME OF THE GAS-WORKS.*

BY M. MALEFANT.

THE product which, at the time of my researches on this subject, offered the greatest interest, was the hydrosulphocyanide of lime, which is present in large quantity; this I have obtained by the two following methods:—

1. I triturate the refuse lime, in a mortar, with a sufficient quantity of distilled water; I allow the mixture to remain in a glass for twelve hours, shaking it from time to time, then, after giving it some little time to settle, I filter off the liquid, which is as limpid as water. This liquid contains caustic lime and hydrosulphocyanide of lime in solution. To get rid of the excess of lime, I pass a current of washed carbonic acid gas through the liquid. As the quantity of CO^2 cannot be exactly determined, to precipitate the lime, one of the following cases presents itself, if the neutralisation be not attended to,—either there remains some caustic lime, or bicarbonate of lime in solution. On this account I pass an excess of carbonic acid through the liquor, at the risk of having a bicarbonate of lime in solution, which I readily precipitate by means of alcohol, of 95° C. At the expiration of a few hours, the bicarbonate of lime precipitates; I filter, and the liquor contains hydrosulphocyanide of lime, which I dry under a bell glass, with lime.

2. I have also obtained the sulphocyanide of calcium by the following means:—I powder the lime in a mortar, and treat it direct with alcohol, at 95° C. After three days' maceration, agitating the mixture from time to time, I filter off the supernatent alcoholic liquor from the calcareous deposit, and evaporate it to dryness under a bell glass, as in the preceding case. The oleobituminous residue is then acted upon by distilled water, which dissolves only the sulphocyanide of calcium; this I pass through a previously washed filter, and again place under a bell glass with lime. Both of these methods were perfectly successful.

* Society for the encouragement of arts, commerce and agriculture, Paris.

SUBSTITUTE FOR PLATINUM SPONGE IN SPIRIT OF WINE VAPOR LAMPS.*

BY WAGNER.

TAKE a saturated solution of sulphate of copper, mix it with a saturated solution of bichromate of potassa, and add a solution of carbonate of ammonia; a yellowish brown precipitate is formed (a basic chromate of copper), which, when well washed in water and dried, is an excellent substitute for either platinum wire or sponge in spirit lamps.

* *Patent Journal.*

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

NEW REGULATIONS IN THE GRANTING OF PATENTS.

WE are very glad to perceive that a step in the right direction has been taken by Her Majesty's Attorney-General, and we hope that the learned gentleman will follow it up by others. The following notice has been issued by the Attorney-General on behalf of himself and the Solicitor-General.

"The Attorney-General, with the assent and concurrence of the Solicitor-General, hereby gives notice, that every person applying for a patent after the 2nd day of Nov. instant., will be required to deposit in

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the office of the Attorney-General or Solicitor-General, an outline descriptive in writing or drawing, to be approved by the Attorney-General or Solicitor-General, before any report will be made on such patent.

(Signed) "JOHN ROMILLY.

"Lincoln's Inn, 2nd Nov., 1850."

This is a very important and useful regulation, and will be regarded as such by all interested in inventions. By the law, as it existed prior to this wise regulation, any man could obtain Her Majesty's Letters Patent for an invention possessing neither utility nor novelty, and thus had a means of gulling the public too frequently found to answer that purpose. Now, however, as the description must be *approved* by the Attorney-General or Solicitor-General, it is to be hoped that an effectual stop will be put to such fraudulent practices. As, however, these learned gentlemen are neither chemists nor mechanics, it appears to us that they ought to be empowered to call in the aid of practical scientific men to enable them justly to award to, or withhold from, the deposited descriptions their approval. The regulation would be rendered far more beneficial by this addition.

By this regulation, the obtaining of letters patent ceases to be a mere legal form; but we doubt whether the Attorney and Solicitor-General will be able to give full effect to it without scientific aid. It appears to us, therefore, that the appointment by the Government of a board of examiners composed of practical chemists and engineers will soon be found indispensable, as, indeed, we have long considered it to be.

Inventors and all interested in patents will thank the enlightened law officers of the Crown for the new order; but they will hope, with us, that it is but an instalment of that entire remodelling of the patent laws which is so imperatively required, and by which, the expenses of obtaining a patent should be greatly curtailed, and the patent, when obtained, present, in itself, a guarantee of the utility and novelty of the invention.

Under the new system now in force, the titles of patents will be properly settled—a most important desideratum.

REPORT ON A MEMOIR RELATIVE TO THE MANUFACTURE OF SUGAR BY M. ROUSSEAU'S PROCESS.*

BY MM. THENARD, BOUSSINGAULT, AND PAYEN.

NEW processes for bringing to perfection the extraction of sugar always excite a lively interest; this is easily understood, for the occupation, at once agricultural and manufacturing, tends to raise the power of the soil in France; it developes industry, and spreads useful mechanical and chemical notions in our fields; it makes the best of the principal product of the plantations.

The sugar manufacture is likewise of great importance, if we consider the number of channels which are open to it; our home markets absorb annually about 120 millions of kilogrammes, and in probably but a short time the use of sugar will greatly increase; it may even be tripled amongst us, if we may judge by the progress it has made amongst many neighboring nations. Every means of rendering its operations more certain and the product more pure, concur to this end.†

During the last forty years, our skilful manufacturers, by means of incessant, various and expensive trials, have introduced remarkable improvements into the native sugar houses and refineries. Nevertheless, difficulties still remain to be overcome, and progress to be made in France, and still more in our colonies; for we only obtain about 0·6 of the sugar contained in the beetroot, and scarcely 0·4 of the quantity, which is, notwithstanding, double, contained in the sugar cane; the inducements to our manufacturing chemists are now greater than ever, and we may hope that the product of the extraction in the large way will soon nearly approach the limits assigned to it by science.

Among the circumstances offering the greatest obstacles to the realisation of the maximum product, we must especially mention the very complex composition of the juices of beet-root and the sugar cane; a composition at all times unstable, and which besides, varies according to the nature of the soils, the seasons, and the periods of the harvest.

* *Comptes Rendus*, 14 October, 1850.

† In England and Scotland, the consumption is 15 kilos. for each individual, four and a half times as much as in France; in Holland, the consumption exceeds 8 kilos., or twice and a half the quantity used here; in Paris, the consumption is 10 kilos. per head, three times the average consumption of sugar in France.

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The direct principles which engender fermentation, those which develope colored or viscid substances often occasion an alteration in the sugar, and cause a still farther complication of very unfavorable phenomena during its extraction. A great number of reagents have been tried, both in laboratories and in the mills, to separate these injurious substances; but two chemical agents only have continued in use: hydrate of lime, which renders several albuminous and pectic matters insoluble, and animal charcoal, which removes the excess of lime, a portion of the coloring substances, and some other foreign matters.

In 1811, M. Barruel, head of the chemical works of the *Faculté de Médecine*, mentioned, in a notice inserted in the *Moniteur*, the use of carbonic acid to precipitate the lime from the juice of the beet root, clarified, as formerly, with about 3 parts of lime to 1000 of juice. M. Baudrimont afterwards tried the application of an analogous means in the large way.

In 1833, M. Kuhlmann, of Lille, supposing that in the ordinary defecation, all the nitrogenous matter of the juice is precipitated, but that there is always a combination of a portion of sugar with the lime, proposed to effect the separation of the lime by a method which appeared to him quicker and more economical than the use of animal charcoal: this was the injection, into the beet root juice, of carbonic acid gas, after the usual defecation.

Still later, in 1838, recalling the experiments of M. Pelouze on the persistence of the properties of sugar when disengaged from its combination with lime, M. Kuhlmann, in other respects admitting that lime prevents the absorption of oxygen by the defecated juice, thought that a process of manufacture might be founded on this persisting quality of the sugar, far from fearing the influence of the lime during the manufacturing operation; that, in consequence, it would be better to subject the sugar, still combined with lime, to many of the operations necessary for its extraction; and that, by operating thus it would be possible to economise the use of animal charcoal, and facilitate the working of the sugar establishments.

Some trials were made according to these indications; the juice was boiled with an excess of lime (15 to 1000), without a complete removal of the scum. The precipitation of the lime by carbonic acid did not take place until after this boiling or partial evaporation, and at a temperature only of from 77° to 86° F.

If the results obtained by these means in the laboratory seemed favorable, they could not be realised in the large way; no manufacturer in France adopted any method of operating founded on this basis.

Things were in this position, when, towards the end of 1848, M. Rousseau employed himself in trying, in the large way, a process for the extraction of sugar, the principal conditions of success in which he had determined by long experience—very different conditions, as we shall see, from those which had been previously mentioned.

He repeated his experiments on small quantities of juice, in the presence of M. Cail, one of our most skilful makers of apparatus for sugar manufacturers, and of M. Lequime, a very experienced sugar maker.

These gentlemen were thus convinced that the new process ought to be very advantageous; they did not hesitate about using it, and obtained favorable results from the first experiments on the large scale.

M. Rousseau's process requires:—1st, the use of a certain excess of lime at a fixed temperature;—2nd, the removal of the scum and precipitates;—3rd, the immediate elimination of the lime combined with the sugar;—4th, filtration through powdered animal charcoal;—5th, rapid evaporation, crystallisation and clarification, by the ordinary means.

If it can be believed, at the first glance, that this process reproduced the means pointed out in 1833 or 1838, that whilst these always failed, the new process succeeded perfectly, the fundamental differences will on a nearer examination be easily perceived.

M. Rousseau explains in his memoir, the characteristics which distinguish his process from the means formerly proposed, and various experiments have verified the facts announced by the author.

We think we can clearly establish the difference, by showing the causes of failure in the first methods, and the essential conditions which have ensured the success of the new process.

The first means indicated by M. Rousseau's predecessors had evidently for aim and for result to separate the lime after an ordinary defecation, or to replace, in these circumstances, animal charcoal by carbonic acid. It will, however, be easy to understand that this substitution could not be advantageous, because nothing replaced the decoloring and purifying properties of animal charcoal.

The second plan was inapplicable in practice, having many serious inconveniences without any compensation. In fact:—1st.

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The incomplete defecation left in the turbid liquid, organic substances, which the carbonic acid finally replaced in the sugar, because it disengaged them from their combination with the lime.

2nd. The juices and syrups containing saccharates of lime, of potassa and of soda, even should these liquids have been clear, could not be evaporated, either as quickly, or as easily, as the solution of sugar isolated from its combination with the bases.

3rd. The evidently higher temperature and prolonged boiling, must cause, with the concurrence of a strong alkaline reaction, a great alteration in many ternary and nitrogenous substances; this alteration is manifested by a disengagement of ammoniacal vapors, and by the developement of a strong odor and brown color; and, supposing that the sugar itself remains uninjured, its extraction in a state of purity becomes more difficult.

4th. In such circumstances, carbonic acid, used to saturate the lime, might arrest the progress of the mischief, but it is powerless to remedy alterations already produced.

We shall now show that the conditions united in M. Rousseau's process are quite different, and that they are founded on new experimental observations.

M. Rousseau performs the defecation with such a quantity of lime, that not only the substances which have a stronger affinity for this base than the sugar, but those that have less, and consequently, the sugar itself, may combine with it.

It results that the saccharate of lime* remains in solution, whilst the foreign substances are separated in greater proportions than in the usual defecation.

The experiments made on the products precipitated by graduated proportions of lime have proved to us that many different organic matters may thus be successively removed from the juice.

The conditions essential to the new defecation consist in pouring hydrate of lime in strong emulsion, into the beet root juice already heated to about 130° F. The temperature is raised as the coagulation becomes more decided;† and, when the thermometer reaches from 176° to 194° F., but particularly before boiling commences, the heating is stopped by closing the tap which admitted the steam.

The clear part is then drawn off, and, by means of filtration, all the flocculent matters held in suspension in the liquid, are carefully separated.

The filtered juice flows directly into a boiler with a double bottom, and the saturation of the lime by carbonic acid gas is then immediately proceeded with.

At first a great froth rises; but as the viscidness is diminished by the decomposition of the saccharates, the saccharine solution, having become more fluid, permits the escape of the gas as if it passed through water. This change guides the operator, who, at the right moment, stops the entrance of the gas.*

Then opening the steam tap, the liquid is heated, by means of the double bottom, until it reaches the boiling point, at which it is kept for several minutes, so as to drive off any excess of carbonic acid, and to complete the precipitation of the carbonate of lime.

The liquid is poured on a filter full of powdered animal charcoal, without waiting for the deposition of the carbonate of lime, for this crystalline carbonate does not prevent the filtration.

The following operations, evaporation, second filtration through charcoal, and boiling, are effected in the ordinary manner, only more quickly and easily; for the syrups being less viscid, better deprived of calcareous compounds, and lighter colored, form a froth only when boiling, thicken more quickly, at a lower temperature, form

* M. Rousseau has observed two states of combination of sugar with lime; the compound most saturated with the base will sometimes give up a portion to the precipitable foreign substances.

† One of the principal signs of a complete defecation by this process, consists in the decoloration and clarification of the liquid; the proportions of lime which produce these effects, three or four times greater than were ever used before, are still stronger as the season advances, so that they should be nearly double towards the end of the year, that is to say, three months after the beet roots have been taken up.

* It will be understood that soda and potassa remain dissolved in the state of carbonate, the alkalinity of which reacts on various nitrogenous and non-nitrogenous organic substances, producing the before mentioned unfavorable effects. M. Rousseau has almost entirely removed this cause of alteration; he, for this purpose, directs the addition of ammonia towards the end of the injection of the carbonic acid. Carbonate of ammonia is formed, which, immediately decomposed by the calcareous salts of organic acids, sets free the ammonia, and forms carbonate of lime; and the organic acids combining with the potassa and soda, destroy almost all the alkalinity.

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no incrustations in the boiler, and, finally, require scarcely two-thirds of the quantity of charcoal used in following the usual process.

The sugar obtained is whiter, with a more agreeable flavor, more easily formed into refined loaves, and ready for consumption immediately after making.

The successive crystallisations, called second, third, fourth and fifth casts, are less difficult and prolonged in syrups which until lately passed into molasses, and give products which are easy of purification in the rotary apparatus.

With these facts before us, may we conclude that this new process will give more sugar and be more economical than the processes hitherto followed? This seems very probable, provided that the greater part of the sugar which rises in the scum, is carefully extracted; for an equal volume of syrup will give more abundant crystals, less animal charcoal will be consumed, the evaporating apparatus will act better and require much less cleaning; the trifling cost of carbonic acid, and the excess of lime, will be quite compensated for by the diminution of other expenses.

In this respect, the names of experienced manufacturers who, having proved the facts which we have ourselves witnessed at M. Lequime's, have adopted this method, present the best guarantee of its worth.

We may mention in the first place, MM. Bernard, Brothers, of Santes, and M. Tilloy, of Courrières (North). The example which they set last year has been followed by M. Hébert and MM. Rhem, Brothers, of Basse Yute (Moselle) by M. Clovis Godin, of Cuincy (North), and M. Alexandre Perier, of Flavy (Aisne). Several proprietors of large estates and sugar mills abroad, after having made themselves acquainted with the results obtained in France, have had apparatus sent to them from MM. Cail and Cheilus to use the system of Rousseau. These are especially: in Russia, Count Bobrinsky and M. Potoki; M. Raut, near Warsaw. Several directors of colonial sugar mills are convinced that this apparatus will be applicable for them. MM. Zuluetta, of the Havana, and M. Robin of Reunion are putting them up in their establishments; we shall therefore soon know how the process succeeds applied to the sugar cane, and in different circumstances from those which are found in France.

At present, we think we may say that in introducing among the native sugar manufactories in France, a new method, the good results of which we have just shown, M. Rousseau has made a step in the extraction of sugar, and has rendered a service worthy of attracting the attention of the Academy, and which merits its approbation.

ON THE ALLOYS OF GOLD AND SILVER USED IN THE MANUFACTURE OF PLATE, JEWELLERY, &c., WITH AN EXPOSITION OF THE VARIOUS FRAUDS PRACTISED THEREIN.

BY WILLIAM GRIFFITHS, WORKING GOLDSMITH.

LETTER VII.

To the Editors of The Chemist.

DEAR SIRS—In my former letters, I alluded to the different methods employed for preparing the alloys of metals for the various kinds of jewellery, &c.: I will now proceed with the system of manufacturing what is called "plated work." As this description of ware forms no inconsiderable proportion of the articles worn and sold as gold, I will enumerate as many of the processes employed as will be intelligible to your readers.

In the first place, I must mention that the plating is of various qualities as well as of different manufactures: that kind made in Birmingham, and used there for cheap ornaments, being invariably of a very good quality of gold, but extremely thin; that made in London and other places by "jewellers" (not platers, as in Birmingham), being of an inferior quality of gold, but the gold on the surface is in a much thicker layer.

To enable you more fully to comprehend my meaning, I will detail the plan adopted by the Birmingham platers. A piece or plate of yellow brass (say an inch in thickness and of any length and breadth the manufacturer may require) is planished (i. e. hammered flat and smooth), then filed until no mark of oxidation or impurity remains upon its surface; it is then carefully rubbed over with borax mixed with water, which treatment preserves the surface of the metal during the heating operation I am about to allude to. A piece of gold, varying in thickness according to the quality of plating required (but to make it pretty good, the gold should be at least $\frac{1}{10}$th the thickness of the brass), is then fastened on the surface of the brass by means of clamps;* the two metals, thus confined together, are put into a furnace, and heat applied until the gold

* Pieces of iron plate so constructed as to bind both metals together to prevent them from warping.

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or alloy of gold, being more easily fused than the brass, as also by the aid of the borax flux intervening between the two plates becomes fused, or, as we term it, "sweated" or "soldered" together; the clamps are now removed, and the two now united plates, viz., gold and brass, are cleaned by means of dilute sulphuric acid, and afterwards rubbed with sand to remove any oxide or other objectionable matter that might interfere with its smoothness of surface. The sheet is then passed between rollers (occasionally annealing to soften it after the action of the rollers) until it is of the requisite thickness. The gold, as I before remarked, is of good quality, otherwise the fusing of its surface to that of the brass would be attended with the probability of a disunion of its particles, in which case it would not be sufficiently ductile to permit of its extension without separating from the brass, so that it is more economical to use a better alloy of gold, say 18 carats, than to run the risk of employing an inferior alloy, where failure in the result would be more probable, especially as the good gold —being more malleable and softer—corresponds better with the comparatively soft nature of the brass; so that the two metals or alloys of metals, when united, roll "kindly" together. When rolled down to a certain thinness, it is worked nearly by the same methods as if it were all one metal—of course always taking care to expose the "best side out." By this system, articles are made which at first present the appearance of gold to the ordinary observer, but, in fact, are nothing more than brass articles with a "pellicle" of gold on the surface—in many instances as thin as gold leaf: this soon discovers itself to the purchaser, who has no alternative but to get the otherwise useless ornament (if such rubbish deserves the title) gilt. This kind of goods is made in immense quantities in Birmingham, and specimens may be seen in almost every fancy shop in the kingdom, their cheapness, except where *very* gross imposition is practised, being the inducement held out to purchasers.

I remember an anecdote, related to me when working in that town which will, perhaps illustrate the system. An apprentice, speaking of the system adopted by his former master, said that he, taking a sovereign from his pocket, desired the lad to stick it (as he termed soldering) on a pound of brass, and get it rolled as long as Livery Street, which is only a mile!

It is fortunate that the inferior way in which most of these articles are got up prevents the imposition, to a certain extent, as, were they better finished, deceit could be more easily practised, and the well-known title of "Brummagem work" would be more frequently uttered than it is at present. In London manufactories, the system is both different in process and in the purposes to which it is applied; it is usually employed for the purpose of giving artificial strength, where the price would not be sufficient to remunerate the manufacturer if he used all gold of a proper thickness for his purpose.

The method of plating in London is different in many respects: in the first place, the gold used is not so good in quality (perhaps of not more than 12 carat, or one third less in value than that used by the Birmingham platers). Secondly, it is not united by fusing the alloy of gold on the surface of the brass, but by soldering the two plates together with the compound already described in a former letter, viz., silver solder. And, thirdly, the gold used does not form less than one-third of the entire substance when rolled, and, instead of being, like the Birmingham plating, perhaps $\frac{1}{20}$th gold to 1 of brass, it is only 2 brass to 1 gold, so that were it not for the purpose of additional strength, it would be scarcely worth while to take the trouble of plating, for the slight advantage gained.

As I intend these papers for the perusal of the practical as well as the scientific man, I will now describe the London workman's method of plating. He takes a piece of gold of the thickness of $\frac{1}{16}$th of an inch, and any size, superficially, that he may require for the work about to be manufactured; he cleans one side, in the manner before described; then, taking a piece of brass, of the same superficial size, but of $\frac{1}{8}$th of an inch in thickness, the surface of which is also cleaned and prepared with borax; then a piece of silver solder of the same size, but rolled until it is not thicker than paper, is then carefully cleaned and boraxed, and the three sheets of metal are then tied together with strong iron wire to prevent warping, the solder, of course, intervening between the sheets of gold and brass; heat is then applied (usually by the blowpipe), until the solder, in consequence of its easy fusibility, "runs" or melts, thus uniting the gold and brass together. The sheet is then rolled to the thinness required, and it may be used for almost the same purposes as gold itself.

The manufacture of plated work is, to the goldsmith, a labor of difficulty, as all the edges of the article, when finished, must be so contrived as to be entirely covered by the gold surface, otherwise, wherever a section occurred, the base metal would be

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perceptible; this object is attained by filing away the brass at the inner angles of the juncture in a similar manner to that in which veneered work is joined* by cabinet makers. In fact the process of making plated jewellery may be considered a kind of *veneering* with metals, and, however deceptive either process may be, the art has in both instances been brought to great perfection, as many excellent workmen have been deceived by mistaking a well-plated London-made article for a solid gold one.

Another system is practised to a great extent, though not so largely as those I have written on; it is a method by which a large article of jewellery may be made to appear very heavy and, seemingly solid, with a very small amount of gold. A thin plate of gold is "struck up" into any form required, in a steel die; this *hollow shell* is then filled by fusing into its cavity a quantity of silver solder; a corresponding half is then affixed, also filled in the same way, and heat applied until the solder runs: the two halves are thus firmly united, and the whole appears one heavy mass of gold. It was by this plan that the old-fashioned watch-seals were made, too often leading the wearer to suppose that, by their ponderousness, they were very valuable, he indulging in this happy state of ignorance until a decline in his pecuniary affairs suggested the propriety of disposing of them, or that, by friction or constant wear, the gold wore off and left the white solder exposed to view.

Were I to detail the numerous and varied methods adopted by dishonest tradesmen to deceive the public, I should fill a volume, especially if I enumerated the various articles so sophisticated, but I think I have already trespassed sufficiently on your valuable space this month.

I remain, dear sirs, truly yours,

WILLIAM GRIFFITHS.

Dublin, 15th Nov., 1850.

A NEW PROCESS OF PHOTOGRAPHY ON GLASS.†

BY MR. A. K. SPARKE, OF DEVONPORT.

I HAVE devised and used for some months the process I am about to detail, and find it particularly adapted for large camera views, and for copying large engravings on glass. The adhesion of the albumen is so great that it never blisters, and blotting paper may be used to absorb the exciting solution, which is spread with a glass rod, thus doing away with the cell of nitrate of silver and considerably cheapening the process. I publish it in the hope that by drawing attention to it great improvements may be made, as the process allows of a great variety of changes.

IODIZING SOLUTION.

The white of one egg, to which add 20 grains of washed iodide of silver, and drop in crystals of hydriodate of potassa enough to completely dissolve the silver and render the albumen again transparent; as this will thicken I add 30 drops caustic potassa, which I find prevents it, and if the albumen is then too thick to flow readily I dilute it with a solution of iodide of silver dissolved in water by the hydriodate of potassa, of the strength of 20 grains of silver to the ounce of water, so as to keep up the strength of the solution to about 20 grains of dissolved iodide to the ounce of solution, and thus diluting or lessening the proportion of albumen in the fluid; allow it to stand, and decant the clear fluid; it is now ready for use, and will be the better for keeping and again decanting.

I spread this over the glass with a rod, and allow it to run off into the bottle, so that the glass has only a very thin film of the solution on it, when it has drained a little (say for a minute) dry at a heat of about 212° F., which may be done over a gas flame or by the fire; *directly* this is cold immerse it in either a solution of alum or dilute sulphuric acid, or acetic acid; if alum, a saturated solution, if sulphuric acid, a drachm to the pint, if glacial acetic acid, a quarter of an ounce to the pint; the latter I now use, and allow it to remain in it some time to dissolve off the soluble salts, if the alum and sulphuric acid be used, a few moments will coagulate the albumen, then wash the salts out with water, and dry, either by the fire or spontaneously. The glass will now have a fine film of iodide of silver in albumen on the glass, which may be seen by placing it on a sheet of blue wove post paper.

It is now excited by dilute solutions of gallo-nitrate, or more concentrated solutions may be used; in fact it admits of any exciting solution that iodized paper does, even to pyrogallic acid, which may be applied with a rod, and if for the camera it may be used damp; if for superposition, it may be blotted off with blotting paper, and then used in the usual way.

After exposure in the camera or otherwise it may be developed by gallic acid, to which is added a few drops of aceto-nitrate of

* The term applied by mechanics to the junction of two angles of 45° to form one of 90°.

† Communicated by the Author.

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silver to the drachm of acid; heat facilitates this process, which is very slow if the picture has not had sufficient exposure. It is then washed and fixed as usual. I have taken pictures 10 inches by 8½ in the camera, and the positive image when varnished is very beautiful.

Honey may be applied to it, either by adding 30 grains to the iodizing solution, or it may be diluted and 4 drops of aceto-nitrate of silver added to the drachm of honey-water, and this used as an exciting solution. Fluoride of potassium may be used as a bath after the bath of acetic acid in the preparation of the iodized glass.

The pictures are transparent, or more or less so, dependant on the thickness of the film of albumen.

ARTIFICIAL MANURE.*

BY M. DEMOLON.

M. DEMOLON, of the department of Finisterre, has patented the following artificial manure:—Dried and pulverised flesh and muscular substances, 3 parts; refuse animal charcoal from the refineries; 5 parts; madrepores in powder, 4 parts. Mix intimately. An enormous mound of madrepores was some time since discovered on the coast, and these have served M. Demolon for one of the constituents of his manure. The madrepores consist principally of carbonate of lime, together with a small quantity of nitrogenous matter. An analysis of the manure gives the following results:—

Organic matters	26·6
Soluble salts	0·3
Phosphate of lime	20·4
Carbonate of lime	40·4
Iron and alumina	0·3
Magnesia and loss	4·5
Silica	7·5
	100·0

For the cultivation of black wheat, M. Demolon substitutes coagulated blood for muscular substances.

ON A NEW PROCESS OF PHOTOGRAPHY ON PAPER, BY WHICH POSITIVE PROOFS MAY BE DIRECTLY OBTAINED.†

BY M. F. BOUSIGUES.

ANY well made paper, slightly glazed, free from soil or metallic stain, is perfectly applicable for this new process. The paper made by Canson and Lacroix of Angoulême, has given me the best results.

Take three sheets and dip them successively into distilled water, and spread them on the glass of the frame, taking care that they should adhere all over by means of a fine cloth. Place the one which appears fittest to receive the luminous impression upon the others; the latter only serve to adhere and retain the moisture.

When this humidity has disappeared, drop on the surface of the paper three or four drops of neutral nitrate of silver, which must be spread quickly with a brush. All trace of this solution will disappear in a few seconds, only leaving on the paper the appearance of a slight vapor. In this state the paper is to be treated in a similar manner to a metallic plate. The vapors of iodine and of bromide of calcium will give great sensibility, but it will be necessary to expose it for a longer time to the vapor of this last substance. I can give the following figures:—

First iodising, 15 seconds; bromide, 35 seconds; second iodising 10 seconds.

The glass is then placed in the frame and exposed to the light, which acts on the paper with almost the same rapidity as on a plate of silver. Mercury causes the appearance of the image.

If the operation is well performed, and the exposure to the light suitably regulated, a positive image will be obtained comparable in beauty to that given on plates, and superior, from the softness of its tints, to those obtained by the ordinary process of gallic acid.

MANUFACTURE OF PAPER, THE WRITING ON WHICH CANNOT BE FALSIFIED, CALLED PAPIER DE SURETE.*

BY M. KNECHT.

PREPARE a pulp of 35 kilogrammes with good and well-washed rags; add 700 litres of water, and then 8 to 10 decilitres of ink, made of sulphate of iron, nutgalls and brazil wood, but without any gum arabic. When the pilon has been at work for about two hours, the water—which at first was colored, becomes colorless in proportion as the coloring matter penetrates the pulp, and becomes incorporated with it. The pulp is then withdrawn, and placed in the vat, and the paper is formed in the usual manner. The shade of color, will, of course, vary according to the whiteness

* *Patent Journal*, 26 October, 1850.

† *Comptes Rendus*, 28 October, 1850.

* *Patent Journal.*

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of the paper and the composition of the ink. Thus, on changing the proportions of the ingredients above mentioned, in adding doses of blue, or of sulphate of copper, a blue, lilac, rose, yellow, orange, or pale green color may be obtained, without entirely removing any one of the principles of the ink, which remains in more or less quantity in the mixture. When the paper thus made has been well sized, the work of the manufacturer ceases, and we arrive at the second operation,—that which has for its object to cause a design in white or in black in the paste. For this purpose,—either by means of a lithographic press, or of wood or copper engraving,—a design is traced on the above prepared paper, this design being formed of gum arabic mucilage which has been allowed to become sour; this sour mucilage acts only on the coloring matter which has been applied,—it has no effect whatever on the constitution of the paper, which may be printed on both sides. As soon as it is ascertained that the gum has sufficiently removed the coloring matter, the paper is plunged into a large back of water, containing a very small proportion of alum; the gum is detached, and the paper withdrawn, dried, and satined, when it is fit for immediate use.

METHOD OF HARDENING OBJECTS IN PLASTER OF PARIS, AND RENDERING THEM LIKE MARBLE.*

TAKE 2 parts of stearine, 2 parts Venetian soap, 1 part pearlash, and 24 to 30 parts of solution of caustic potash. The stearine and soap are cut in slices, mixed with the cold lye, and boiled for about half an hour, constantly stirring. Whenever the mass rises, a little cold lye is added. The pearlash, previously moistened with a little rain-water, is then added, and the whole boiled for a few minutes. The mass is then stirred until cold, when it is mixed with so much lye that it becomes perfectly liquid, and runs off the spoon without coagulating and contracting. Before using this composition, it should be kept for some days well covered. It may be preserved for years. Before applying it to the objects, they should be well dusted, the stains scraped away, and then coated by means of a thick brush with the wash as long as the Plaster of Paris absorbs it, and left to dry. The coating is then dusted with a leather or soft brush. If the surface has not become shining, the operation must be repeated.

* *Patent Journal.*

IMPROVEMENTS IN THE MANUFACTURE OF BLACKING.*

BY M. JACQUAND.

M. Jacquand's process is as follows:—Place in any suitable vessel 200 kilogrammes (4 cwt) of molasses, and 30 kilogrammes (67¼ lbs) of animal grease, and raise the temperature by means of steam or other heat, so as to melt the fatty matter, and increase the heat to a temperature of 200° C. (392° Fah.) When the grease is thoroughly melted, add 100 kilogrammes (2 cwt.) of animal charcoal, in fine powder, and stir these three substances together for two or three hours, until a perfect mixture is obtained. Next introduce gradually and continuously, by means of syphons, drawn out to a fine point, 25 kilogrammes (½ cwt.) of sulphuric acid, and afterwards 15 kilogrammes (33¼ lbs.) of muriatic acid, and continue the action of the stirrer for two or three hours. After remaining two hours at rest, renew the stirring, adding by degrees a very small quantity of some essential oil, according to the odor which it is desired to communicate to the blacking. When cold, it is further submitted to the action of a roller mill, when it is ready for the market. The patentee claims as new:—1. The elevation of temperature so useful in rendering complete the action of bodies on one another, and thus also preventing much subsequent labor. 2. The substitution of animal grease for the vegetable oils, which last do not form a good combination with the other substances employed. 3. The addition of the sulphuric acid by means of fine syphons, thus rendering the action of the acid slow and continuous, and giving to the paste a degree of fineness and smoothness unattainable by any other process. 4. The construction of large reservoirs, by means of which a more perfect homogeneousness of product is obtained.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.†

Improvements in the manufacture of gas for illumination and other purposes to which coal gas is applicable, in preparing materials to be employed in such manufacture, and in apparatus for manufacturing and using gas; also improvements in treating certain products resulting from the distillation of coal; parts of which above mentioned improvements are applicable to other similar

† Collected from *The Mechanics' Magazine.*

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purposes. RICHARD LAMING, of the New Chemical Works, Isle of Dogs, Middlesex, chemist, and FREDERICK JOHN EVANS, of the Horseferry Road, Westminster, gas engineer. Patent dated April 23, 1850.

The patentees claim—

1. The introduction of asbestous or fibrous silicate of magnesia among the materials used for making articles of clay intended to be used under circumstances where they are submitted to a great heat, and also the exclusive use of articles thus manufactured.

2. A peculiar and arrangement of apparatus, particularly the large funnel and double chamber and front man-hole doors, for the purpose of making gas for illumination by the decomposition of any suitable hydrocarbons or water exposed in a fluid state to the action of red-hot coke, without, however, claiming the manufacture of such gas.

3. The elongation of the induction pipes of retorts used in the manufacture of gas for illumination, along or near their axes.

4. The production of light, in any suitable apparatus, from coal or peat gas, by heating platinum, either in the form of wire or foil, to a white heat, by means of which the light produced is increased in purity and intensity, and gas of inferior quality may be employed with advantage.

5. A combination of processes for making a material suitable for the purification of gas from chloride of calcium in combination with precipitated oxide of iron or copper.

6. The purification of coal gas by means of sulphate of lime mixed with sulphate of iron, or sulphate or muriate of manganese, or muriate of iron, or even sulphate or muriate of copper (by preference, however, sulphate of iron), and the employment of this mixture, when exhausted for purifying purposes, as a manure.

7. The purification of coal gas by means of a mixture composed of hydrated or precipitated oxide of iron or copper and carbonate of lime, magnesia, sulphate of magnesia, or magnesian limestone.

8. The purification of coal gas by means of chloride of magnesium or sulphate of magnesia and water diffused through sawdust or other solid matter capable of exposing an extensive surface, saturated with these agents, to the gas, without impeding its progress through the same.

The next six claims refer also to the purification of gas, and recovery of the different agents employed for that purpose, and also to obtaining sulphate of ammonia from the mixtures used in or resulting from these purifying processes; after which the patentees go on to claim—

15. A method of manufacturing prussiates of potassa, soda, and ammonia from the sulphates or carbonates of these bases, by treating them with prussiate of lime.

16. The manufacture of carbonic acid gas for converting hydrosulphate of ammonia into carbonate of ammonia, and for other useful purposes in the arts, by exposing a mixture of deutoxide of copper and carbon in powder, to a red heat, in suitable close vessels, and,

Lastly, a method of treating peat to be used either for the manufacture of gas, for conversion into charcoal, or for other purposes, such as fuel. The peat, as dug, is reduced in mills, in manner exactly similar to the treatment of chalk in the manufacture of "whiting." It is then mixed with water, passed through a wire sieve, which retains the fibrous portions. After being allowed to settle, the supernatant water is decanted off, and the magma collected and dried in the air, or by other suitable means, when it will be ready for use.

A new and improved mode of conducting consuming, and disengaging smoke from its deleterious compounds. PETER ARMAND LECOMTE DE FONTAINMOREAU, of South Street, Finsbury. (Being a communication.) Patent dated April 23, 1850.

This invention has first for its object the formation of flues or conduits below the ground and underneath the streets of a city, through which the products of combustion from every house are to be conveyed to some place to be subsequently treated and acted upon

2. A particular construction of pipes or flues, through which the smoke from every room in a house may be conveyed into the street conduits, and wherein the smoke may be partly freed from its soot.

3. The formation of a general receiver, wherein the products of combustion passing along the street conduits, may be operated upon: this large receiver is to be placed at the bottom of a tall shaft or chimney.

4. The employment of machinery, which consists principally of a large water-mill wheel for lifting, spreading, and throwing about fluids employed to act upon the gaseous products from the conduits.

5. A method of consuming that portion of the smoke which has escaped from the previous processes, by means of a large fire placed in the upper part of the shaft or

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opening for the general escape of the purified gases or products of combustion.

An improved manufacture of vegetable fluid to be used in the production of artificial light, and in lamps or burners for consuming the same, which vegetable fluid is also applicable to the manufacture of lacker or varnish. ABRAHAM MOSES MARBE, of Birmingham, chemist. Patent dated April 18, 1850.

This invention has for its object the production of an inflammable fluid which shall give a good light without so dense a smoke as is produced by the combustion of unprepared hydro-carbon, and possessing also the advantage of not forming a crust like the spirit now in use.

For this purpose the patentee proposes to employ various hydro-carbons,—such as wood-tar spirit, oil of turpentine, native naphtha, coal-tar naphtha, and the naphtha obtained from bituminous substances; all of which are first purified and then mixed with alcohol or pyroxylic spirit in certain specified proportions.

Wood-tar spirit and oil of turpentine are both purified by adding to each gallon thereof a pound of sulphuric acid, and a quart of water. After standing two or three hours, the clear liquor is decanted into a vessel containing water, by which the remaining acid is separated from it, and a suitable vessel being then prepared, containing for every gallon of liquor a quarter of a pound of ground or pulverised lime, the whole is to be poured gradually in and stirred together. After settling, the supernatant liquid is to be drawn off by taps placed at different heights in the side of the vessel. In this state the hydro-carbons may be used instead of camphine in lamps of the ordinary description; but in carrying out this invention it is requisite that a certain quantity of alcohol or pyroxylic spirit should be added. To deprive the hydrocarbons of the water which they contain, they are submitted to the following process:—A vat is prepared in which are placed a quarter of a pound of pulverised lime, and half a pound of calcined potassa to every gallon and a half of the spirit. At the first and each successive wetting a vapor arises, which must be allowed to subside before more alcohol is added, as by pouring it in gradually the proper action of the lime and alkali will be ensured. To the alcohol thus treated is added one gallon of purified hydrocarbon, and on distilling the mixture an inflammable fluid will be produced suitable for illuminating purposes.

Naphtha is purified with nitric instead of sulphuric acid, in the proportion of half a pound of acid and a quart of water to the gallon, and when purified, one gallon and a half to the quantity of alcohol obtained in the second process.

The patentee observes, that when sulphuric acid is employed, the product is a colorless fluid, but that nitric acid imparts a brown tinge.—Other acids, such as nitro-muriatic and nitrous, and other alkaline substances may be used; and he states that he does not intend to limit himself to the exact proportions given, which may in some cases require to be varied. He also observes, that he does not claim the mixing of alcohol or pyroxylic spirit with hydrocarbons, except for the purposes of his invention, such mixing having been previously practised.

The rectified spirit produced by distillation may be used instead of alcohol, and in a similar manner in the manufacture of lacker and varnishes.

Various modifications of the treatment of hydrocarbons when mixed in certain proportions are also described, in some of which the purification is effected by nitro-muriate of tin, and in others by nitrate of iron.

The improved "lamps and burners" are intended to be used for consuming the rectified spirit, and descriptions are given of a wall and table lamp, chandelier, ship's light lanthorns, &c. The principle is however much the same in each case, the spirit being supplied by capillary action, and burnt either in a partially vaporised state, or as customary in spirit lamps. For lighting burners of the first class, an instrument is employed consisting of several thicknesses of wire gauze attached to a handle; when dipped in some inflammable matter, this holder retains a sufficient quantity of heat to partially vaporise and ignite the spirit; to prevent any drops from falling from this instrument on the table, a cup is placed round the wick to receive them. The burners described are applicable only to lamps for consuming the rectified spirit prepared according to this invention; but as before observed, if it is desired to use the prepared and purified hydrocarbon previous to distillation, spirit lamps of the ordinary construction are stated to be fully equal to the purpose.

Claims.—1. The manufacture of a fluid suitable for illumination from hydrocarbons, alcohol, and pyroxylic spirit, treated and purified with acids, lime and alkaline substances, and distilled together, as described.

2. The manufacture of a fluid suitable for illumination from hydrocarbons purified and

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treated with acids, lime and alkaline substances, as described.

3. The production of a fluid suitable for illumination from hydrocarbons purified and treated with nitro-muriate of tin, as described.

4. The production of a fluid suitable for illumination from hydrocarbons purified and treated with nitrate of iron, as described.

5. The production of a fluid suitable for illumination from hydrocarbons purified and treated with nitro-muriate of tin, or nitrate of iron, either alone or in combination with naphtha or oil of turpentine, or alcohol, or pyroxylic spirit, as described.

6. The employment of the fluid produced by the distillations of hydrocarbons treated and purified as above described, in the manufacture of lacker or varnish; and

Lastly, the adaptation of lamps and burners, as described and shown to be used with the prepared and distilled fluid manufactured by means of the processes described.

Improvements in the manufacture of candles and oils, and in treating fatty and oily matters, and in the application of certain products of fatty and oily matters. CHARLES HUMPREY, of Downing College, Cambridge, M.A. Patent dated April 23, 1850.

The object proposed to be effected by this patentee, is the conversion of all oils into a substance resembling sperm oil, which, as is well known, is essentially different from all other oils, inasmuch as it is not oxidised by exposure to atmospheric air. The cause of this difference has never been satisfactorily explained. "Oleïne," under which term all oils may be included, consists of oleïc acid and glycerine (the protoxide of glycerule); it is also bi-basic, each atom of oleïc acid being combined with two atoms of the protoxide of glycerule, and hence oleïne is chemically the "basic oleate" of the protoxide of glycerule. Referring to the law with respect to oxysalts, it is well known that the oxygen in the acid bears a proportionate ratio to that contained in the base; and if a neutral salt capable of oxidation be formed, and caused to pass from the state of a protoxide to that of a deutoxide, one atom of base will be eliminated and set free, the remaining atom combining perfectly with the acid.

Now with respect to oleïne, it has been hitherto supposed that absorption of oxygen produced a new acid, termed elaidic, which, combining with the glycerine, converts it into a fatty matter termed elaidine. But this theory fails to account for the invariable production of a gummy substance (the "*corps rouge*" of the French chemists). If, however, we suppose that, by absorbing oxygen (as in the case of the oxysalts above alluded to), the two atoms of glycerine or protoxide become two atoms of deutoxide, then one atom would saturate the acid, and the other atom of glycerine, or possibly deutoxide of glycerule, be eliminated and form a gum, which would be the "*corps rouge*" above alluded to. The saturated acid would then form a neutral salt, *i. e.*, peroleate of glycerine, in every respect essentially identical with sperm oil, which, from various experiments made by him, the patentee is convinced to be a true chemical peroleate of the deutoxide of glycerule.

The habits of the sperm whale are such as would account for the oxidisation of the oleïne contained in its food, which is almost wholly animal. This whale is furnished with air-breathing lungs, and the oxygen thus inhaled would, during the process of digestion, as is the case with all carnivorous animals, produce naturally effects similar to those which it is now proposed to obtain by artificial means.

The matters most suitable for oxidising oleïne and stearine, are nitrous and hyponitrous, which possess the capability of being reoxidised by contact with atmospheric air, after surrendering their proportionate quantities of oxygen to a deoxidising agent. If this operation be performed in a Woolf's apparatus, having its cells charged alternately with oleïne and atmospheric air, the deep orange-colored fumes will be seen to change color during contact with the oleïne; then, on entering the air chamber, they recover their lost oxygen and their color, and again surrender them to the fatty matter, and so on till the residual azote of the air becomes so bulky as to impede the operation. The eliminated atom of glycerine will be found adhering to the sides and bottom of the vessel.

Stearine, or the concrete part of animal fat, may be similarly treated with analogous results. The mixture of perstearate and peroleate, formed by treating tallow, is a highly inflammable substance, harder than ordinary tallow, and capable of being without further preparation moulded at once into candles.

The first operation is practically valueless unless the eliminated glycerine be removed. This may be effected either by the use of alcohol, ether, water, pyroligneous acid, or alkaline solutions. Passing by the spirit as too expensive, the water as occupying too long a time, and the acid as being injurious to the oleïne, alkalis only remain available.

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But all alkalis, at the same time that they absorb or combine with glycerine, have a strong affinity for oleïne, which, under their influence, is converted into a soap. To obviate this saponification the patentee proposes to employ a saturated solution of chloride of sodium (common salt) to which is added from 2 to 3 per cent. of alkalimetral caustic soda. This mixture, in a cold state, is to be added to the purified fluid oleïne, at a temperature of about 90° F., in at least equal quantities, but it is better to have it in excess even if the proportion per cent. of alkali be reduced. Solidification to a certain extent immediately ensues, and after allowing a plenty of time (say, perhaps, a day or more) the mixture is to be heated to 150° or 160° F., and when it is perceived that a portion of the glycerine has begun to settle, the heat may be safely raised to the boiling point. The peroleate is then skimmed or poured off, and the glycerine sets, when cold, into a firm jelly. As the peroleate consists partly of solid and partly of fluid fat, they are to be separated by the methods of bagging, pressing, &c., in ordinary use. Under this part of the invention the patentee claims :—

1. The oxidising of oleïne and stearine by the agency of nitrous and hyponitrous gas, alternately deoxidised by passing through the fatty body and reoxidised by contact with atmospheric air. Preferring the apparatus and mode of operation described.

2. The removing the eliminated glycerine, protoxide of glycerule or gummy matter from oleine or stearine artificially oxidised by the use of alkaline solutions. Preferring the mode of operation described.

3. The combined application of the above processes to obtain pure peroleate and perstearate of glycerine.

Mr. Humfrey next proceeds to observe that oleïne and stearic acids are susceptible of treatment similar in principle to the above; but as the products resulting from this treatment are not of such obvious utility as those obtained by preceding methods, we omit the description of the process. Under this head of his invention Mr. Humfrey claims—The acting on fatty acids by means of nitrous and hyponitrous gas alternately deoxidised by passing through the fatty body, and reoxidised by contact with atmospheric air.

When the first of the operations, before described, is performed on a scale more extensive than that of a mere experiment, the following apparatus (referred to in the claims) is recommended as applicable. A long shallow trough of pottery ware or other material, say 24 feet long, 4 feet wide, and 6 inches deep. The cover fits on air-tight, and has attached to it at certain intervals partitions which are of such depth as just to dip under the surface of the oleïne, with which in carrying out this operation the trough is about half filled. These partitions serve to divide the trough into compartments, to each of which is fitted a pipe for supplying air, which pipe is closed at pleasure by a cock. At one end of the apparatus is a chamber for generating the gas and the other is continued upwards, and forms a shaft which is rendered partly vacuous by a jet of high pressure steam, by which gas is drawn through the whole length of the trough, alternately surrendering its oxygen to the fatty body, and receiving it again by contact with the air, which fills the upper portion of each compartment. A pump attached to the trough keeps up a circulation of the matter under operation. The patentee prefers to create a draft in the shaft, or chimney, by means of a steam jet; for which, however, other means may be substituted, such as a blower or fan.

A second branch of the specification relates to the manufacture of certain dyes and pigments from stearic, oleïc and elaidic acids, combined with suitable metallic protosalts. Thus a color resembling verdigris (the acetate of copper) may be made from oleïc acid neutralised by soda, so as to form an oleate, and a neutral solution of sulphate of copper in boiling water. "Scheele's green," and "emerald green," may be also manufactured in a similar manner. When the protosalts of other metals are employed in combination with one or other of the above-named acids, various colors can be produced; care must, however, be taken that the solutions of each are perfectly neutral. Thus salts of iron produce a beautiful mahogany brown—of zinc, a buff—of manganese, yellow—of tin, brilliant yellow, &c.

Claim.—The treating of fatty acids with certain metallic oxides and peroxides, for the purpose of producing salts to be used as pigments and dyes.

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III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE PHARMACEUTICAL SOCIETY.

THE Memorial has produced a lasting impression on the ruling clique of the Pharmaceutical Society. It has taught them that their position is not the secret snuggery in which they had imagined that they had ensconced themselves for life. They have learned that there is a power superior to theirs, which will not submit to an abuse of their functions. Had the Memorialists followed up the blow they had struck, wisely and boldly, instead of resorting to anonymous circulars, which have a tendency to discourage the friends of the cause and to embolden its enemies, they would ere this have conferred an enduring benefit on the members of the Society.

The authors of the circulars and the memorial—for they are the same—must by this time have discovered the truth of these remarks; for when the Memorial with its numerous signatures appeared, the enemy was dismayed, knowing not where to fly for succour and for help, and ready to submit to any terms rather than be for ever annihilated. The memorialists, satisfied with their success thus far, hesitated to push their advantage to an extremity; the enemy, seeing this state of affairs, gained courage, and went earnestly to work to counteract the effects of the Memorial. The memorialists were now alarmed at their own shadows, for they immediately fell back on the anonymous, as though they were terrified at the results of their formidable attack, and were glad to screen themselves from its consequences. Want of vigor and address on the part of the originators of the Memorial will more than fully account for its not being eminently successful. The "hour" was come, but the "man" was wanting. They fain would climb, but they feared to fall. Their cause being a righteous one, it failed only by reason of the pusillanimity of its advocates.

The want of success of a first attempt ought not to discourage those who believe in, and desire to see removed, the great abuses of the Pharmaceutical Society, for there are men amongst its members perhaps too fond of retirement, who are equal to any emergency—men, who by nature and education would do honor to any cause or society, could they be enlisted in its service. It was the fear of these men standing forward in behalf of the Memorial that struck terror into the hearts of those who create and participate in the profit of the evils they perpetually strive to engender. But when the evildoers ascertained that these men stood aloof from any active participation in the movement, and that the battle was in the hands of a set of imbeciles, the enemy at once recovered its courage and manifested its contempt for them.

This account is, we believe, a correct and concise one of the causes which have led to the failure of the crusade against the outwork of corruption which cupidity has built up as a protection for the citadel of aggrandisement within the Society.

We now turn to Mr. Bell's defence of the charges and statements we have thought it our duty to make respecting the condition of the Society. One of our statements is, that upwards of 1000 persons have seceded from it. It is curious to observe by what juggling of figures Mr. Bell attempts to wriggle out of an admission of this fact, which even he is not foolish and mendacious enough to directly deny. He says that some members are dead, forgetting, or seeming to forget, that the new acquisitions have more than compensated for the mortality. He also states a fact which will not help his statement, but rather damages it, that some of the associates have become members since the formation of the Society. It must be manifest to any one, not wilfully blind, that this change of degree of relationship to the

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Society cannot affect in the least the gross number of members and associates. In short, it clearly shows that more of the original members have withdrawn from the Society, than a comparison of the actual figures of the present year and of the year of its greatest prosperity would indicate.

All Mr. Bell's twaddle about the present difficulties of obtaining membership is quite foreign to the matter at issue. These difficulties have no connection with the members and associates who have retired from the Society because the Society had broken faith with them; in truth, the obstacles to the admission of membership would rather have induced them to remain attached to the Society, as will be readily proved when that or some other society or college obtains an Act of Parliament for the better education and protection of pharmaceutists.

Mr. Bell indiscreetly lets slip one statement which we were not aware of, viz., that many of those who have been educated within the walls of the Society have withdrawn their support from it. This little fact speaks volumes, especially when we remember that he is constantly telling the discontents that if they were better acquainted with the workings of the Society, they would estimate it much more highly than they do at present.

Whilst on this subject, we must notice Mr. Bell's *ingenious* refutation of our charge that his pet Pharmaceutical School is a pauper establishment. He tells us that the customers of a tradesman are not necessarily paupers when the tradesman cannot live on the profits derived from the sale of goods to them. This is a truth which could not have occurred to any mind less gigantic than his. But, nevertheless, we beg to remark, with all humility, that, in spite of his analogy, we still cannot discover any difference in the features of the Pharmaceutical School and those of any other charitable educational institution. Granting for a moment that the case of the tradesman's customers holds good as regards the pharmaceutical pupils, we maintain that that tradesman is a pauper to all intents and purposes who lives by public or private eleemosynary aid. Consequently, by analogical reasoning, assuming that the pupils are not in the position of paupers, then it must result that the professors are the paupers, or recipients of unearned gain, they being in a parallel position to the tradesman. Therefore our cotemporary is pinned to a dilemma. He may accept that horn which best serves his purpose, so far as we are concerned.

The School has never been exhibited in its true light, as regards its enormous cost to the Society. We have shown, on a former occasion, that the expenditure for the School was upwards of £6300 above the fees paid by the pupils. We then left out of consideration that the rent and taxes of the premises in Bloomsbury Square ought to be nearly all charged as the cost of the school, for the chief part of the house is devoted to its purposes. This item would amount to about £1500, after making the necessary deductions for the parts otherwise occupied. There could be added to this aggregate sum of £7800 several other expences, but we have not space on the present occasion to devote to them.

Greatly is it to be regretted that all the important features of the Pharmaceutical Society should be quietly sacrificed to the idol of a school which a few members have set up for their worship. The library is left to its fate. No new works have been purchased for several years; consequently, it is valueless as a library of reference for the members, in consequence of the rapid strides which chemistry has made in a few years.

The Council is liberal to prodigality to the School, and parsimonious in the extreme to the other departments of the Society. No greater proof of this mistaken meanness can be instanced than not paying the examiners adequately. It has voted them five guineas a year each, after having received their services gratuitously for some years. But there is this excuse for it,

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that probably it considered that their services were not worth paying for at all. Possibly the Council was correct in its judgment. One thing is certain, that their labors are worth either much more than five guineas a year, or nothing.

We cannot comprehend the policy of well-remunerated professors and gratuitous (or nearly so) examiners, for they ought to be at least equal in talent and acquirements with the professors: if the Council wishes the examinations to be efficacious and respected, it would do well to take a lesson from the College of Surgeons, and even the Apothecaries' Company, in this respect. They are not ashamed to avow publicly the names of their examiners. Examination by incompetent persons is a solemn farce, and the only sure method to elevate the educational character of pharmaceutists, and to confer value on the diploma of the Society is to secure as examiners the services of men of recognised ability, at whatever cost.

Luckily for the examiners, the examinations are privately conducted, or their vanity and assurance would have long since reaped their reward, by such a shout of indignant scorn and contempt as incapacity deserves and receives when publicly exhibited. The pupils are taught, or are professedly taught, analytical chemistry. Who amongst the examiners are analytical chemists? The pupils are instructed in materia medica by Dr. Pereira. Where are the Pereiras, or even sucking Pereiras, who examine them? The pupils attend courses of theoretical and practical botany. Who amongst the examiners aspires to be the Lindley or the Forbes to test their efficiency?

If there be one point where the Pharmaceutical Society is the weakest, and where it ought to be the strongest, we unreservedly assert that it is in the qualifications of the examiners. Common sense, worldly prudence, or great success in mercantile pursuits, may suffice for an auditor, or a member of council, or even, perchance, for the editor of a journal, for the duties of the latter may be accomplished by a qualified deputy; but scientific acquirement and ability alone are the *sine qua non* of an examiner.

SANITARY NOTES.

NO. X.

THE Corporation of the City of London have given the usual notices of an intended application to Parliament for an act relative to Smithfield. The notice is headed "Enlargement of site of Market and improving approaches. Change of market hours. Amendment and Extension of Acts. Removal of Dead Meat Market from Newgate. Levying Tolls, Stallages, Ties and Dues, Raising money, and the application thereof."

The notice proceeds to detail the intention of acquiring power to purchase certain properties, which define the plan as being the same in its main features as that which was put forward by the corporation before the commission of the present year.

This plan is, in brief, to remove Smithfield Market from its present locality to the ground lying between that and Victoria Street, an extent of 12 acres, now covered with a dense mass of buildings. With respect to the present straggling market, about one acre is included in the above 12 acres; the part lying between Charterhouse Lane and Long Lane is proposed to be occupied by lodging houses, and that between Long Lane and Giltspur Street as a hay and straw market, with a building for baths and washouses in the centre; the part opposite Long Lane, and between that and the new market, or about half an acre, being open, with a reservoir of water in the middle.

In addition to live and dead meat markets, it is proposed to buy three quarters of an acre of land on which to erect slaughter houses. This piece of ground is outside the city boundary. At the very time that one part of the Corporation is seeking power to *erect slaughterhouses in the county*, but adjoining the boundary, another part, viz., the Commission of Sewers, is seeking for act to continue and extend its powers, and, amongst other things, to have power to *diminish the number of slaughterhouses in the city*. The latter is done as a step in sanitary improvement; the former does not come under such consideration, as it is out of "the city." This lordly hypocrisy is as offensive as the subject matter of its display.

The plan of the market comprises 8¼ acres for a live cattle market, and 3¾ acres for a dead meat market. It is not yet stated whether it is now proposed, as it was last spring, to provide lairage, (or

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rather stallage, for they were "to be all tied up,") for 1,000 bullocks and 5,000 sheep. It is to be hoped that this monstrous idea is abandoned, but the term "stallages" in the notice is suspicious. To have 6,000 animals permanently established in the heart of London, with all their accompanying nuisances, aggravated by the small space which was allotted for the purpose, was a proposition that was simply disgraceful to those who made it; its unfeasibility was unquestionable.

The 3¾ acres appropriated to the dead meat market include the thoroughfares on three sides and the footway along Victoria Street. The actual extent of the market itself is 108,800 square feet. The remaining 55,000 square feet form the area for carts, &c., and are at the same time the roads of access to and departure from the market for the cattle. To remedy the confusion this would cause, the carts may stand in Victoria Street, which, when completed, will be a main thoroughfare. Verily, the city authorities have strange notions of what the public convenience is, to imagine that by removing the obstructions from one street and allowing them to form in another is "removing a nuisance."

Now let us proceed to examine the proposed new live cattle market. The champion of Smithfield, (Mr. H. L. Taylor) said to the commission:—"It is very important that you should not lose sight of the fact that the proposed new market contains 8¼ acres for the live cattle, and the whole of the present market is only 6¼, which includes the foot and carriage ways." This fact should certainly not be lost sight of, for it is one of the worst *facts* in the whole case.

Their own proposition is that the new market shall accomodate 5,000 bullocks and 36,000 sheep. The present market will hold 2,750 bullocks, tied, and 1,250 in ringdroves which are formed in the thoroughfares, and 30,000 sheep. Adopting the same proportions of space for the additional number of cattle and sheep, the additional space required would be 1½ acres, making altogether 7¾ acres; so that virtually, as the new market is to accomodate a greater number than the present one, the additional area, granted to comply with demands for more room, amounts to half an acre! The numbers now sold in yards and lofts, and those waiting for admission in the neighboring streets, will in future be admitted into the market, but the crowding, crushing and steaming will remain much as before. The unhappy fat cattle, which at present have but 19½ inches breadth allowed them, will in future obtain about 21 inches; but the sheep must still be laid at the rate of three upon 8 square feet.

The drainage from this precious market place is to be scoured down into the Fleet sewer; and the additional mass of dirt from this source, and washings from the slaughterhouses will contribute in no mean degree to increase the deadly exhalations from that notorious sewer, when backed up by the rising tide. All the offal dressing manufactories of every description, which make the Saffron Hill district of London a black plague-spot, from which Disease and Death send out their myriad agents over the whole town, are to be confirmed in their vested rights, by the undoubted permanency of that which originally caused their location.

Confirmed! aye, and made worse if possible; for the wholesale destruction of houses commended by some, as a removal of a mass of evil, will increase the crowding in the neighbouring streets, and with that, the dirt, disease and crime.

The subject is a most serious one; and it is to be hoped that the public excitement on other subjects, and the weakness of Government will, not have the effect of allowing the Corporation of London to obtain from Parliament authority to carry out a measure which will oppose an irrevocable obstacle to the complete sanification, as well as to long-sought improvements in the safety and morality of a large portion of this great metropolis.

ARISTOTLE AND THEOPHRASTUS.*

BY M. CAP.

ARISTOTLE was born at Stagira, towards the end of the fourth century before our era. His father, who was called Nicomachus, was physician to Amyntas, father of Philip, King of Macedon, and pretended descent from Machaon, son of Esculapius. Left an orphan, at very tender age, Aristotle was brought up by his tutor, whose name was Proxenus; his education, which was directed with skill and devotion, did not prevent the young pupil from rapidly dissipating his patrimony. He then became a soldier, and went to Athens, where, deprived of resources, he exposed medicaments for sale in the public places, and thus derived profit from the medical knowledge he had acquired from his father and his tutor. Certainly, it is not for us, like Epicurus, to make it a kind of reproach to Aristotle to have exercised the profession of Pharmacien,

* *Journal de Pharmacie.*

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or Rhizotone. Theophrastus remarks that a great number of physicians and learned persons then applied themselves to the study of plants, and extracted from them useful medicaments. Who knows whether it was not from such researches that Aristotle imbibed the taste and afterwards developed the genius of natural history?

It was at the same period that Plato opened at Athens his celebrated school of Philosophy: Aristotle became, and remained for 20 years, one of his most assiduous pupils. He himself opened a school, in which he rivalled Isocrates as a philosopher and orator. But he had already devoted himself to philosophy, eloquence and natural history, and his reputation had attained such a height, that Philip, King of Macedon, soon after the birth of Alexander (356 B.C.), wrote him the celebrated letter: "Philip, King of Macedon, to Aristotle, greeting. Know that a son has been born unto me. I thank the gods, not so much for having given him to me, as for having caused him to be born in the time of Aristotle. I hope that you will make of him a king worthy of succeeding me and of commanding the Macedonians." Some time after the death of Plato (348 B.C.), the Athenians having declared war against Philip, Aristotle repaired to Atarna, to Hermias, his friend, who was the governor there. Treason and the cruelty of Artaxerxes having caused the death of this friend, the philosopher perpetuated his memory in a piece of admirable poetry, raised a monument, and married Pythaïs, his sister. At about this period, Philip called him to his court and entrusted to him the education of Alexander, then thirteen years old.

The master and pupil passed several years together at a retreat in the country called the Nympheum, situated near Mieza. Philosophy, the letters and the arts, the physical and natural sciences and even medicine, entered into the plan of this education. Philip having been assassinated (336 B.C.), Aristotle remained at the court until Alexander carried the war into Asia. It has been pretended that he followed him in his first expeditions; but he hastened to return to Athens, where he established the Lyceum, and founded his new philosophical school.* After the death of Alexander, Aristotle was attacked by some rival philosophers, and by fanatics who accused him of impiety. He did not consider himself bound to maintain the dispute, and, to save the Athenians, as he said, another attempt against philosophy, he retired to Chalcis, in the island of Eubœa, where he died at the age of 63 years (322 B.C.).

The variety, or rather the universality of knowledge which characterises the writings of Aristotle, renders the task of presenting even a simple analysis of the works of that eminent man a difficult task. However, as we have to consider him only with relation to the impulse which he gave to physics and to natural history, we will endeavor to confine ourselves within the just limits which our subject prescribes.

Physical science, at this period, was still inherent to philosophy, of which it formed one of the principal branches. Aristotle, a pupil of Plato, for a long time adopted the principles of the Platonic school; but his more methodical and colder reason not always accommodating even the most ingenious hypotheses, when not based in the reality of phenomena, he felt the necessity of opening a new way, by giving to science a more solid basis, and he soon departed from the principles of his master, profiting by his errors.

The philosophy of Plato evidently coincided with that of Pythagoras. His system, which is that of scepticism, was based on universal doubt. Aristotle proved, on the contrary, that all knowledge transmitted by the well-directed senses should be regarded as certain, and that nothing could enter into the mind except by the medium of the senses.* Plato and Aristotle are, as is evident, the chiefs of the two great parties which have divided philosophers from antiquity to our time. The one attributed to the ideas an existence independent of the testimony of the senses, and pretended to determine from the definition of things their real nature; the other affirmed that our ideas always have their point of departure in observation and experience, and are conceived or developed only by abstraction. In these two opposite fields the philosophers of all ages have successively been ranked. With Platonists, the idealists and realists; with the peripatetics, the nominalists and empirists. In our time, the ideologists are still attached to the system of Plato, whilst those who cultivate the physical sciences acknowledge that they owe to the system of Aristotle all that they positively know concerning natural things. In this respect, Locke and Newton may be regarded as the modern chiefs of the peripatetic school.

* This school was called peripatetic, because Aristotle gave his lessons walking about. (From περί, around, and πατέω, I walk.)

* *Nihil est in intellectu quod non fuerit prius in sensu.* (Analyt. Poster. Lib. I., c. 18).

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The Italian school attributed to the elementary atoms a determinate form which was based on no real foundation.* Aristotle did not admit this hypothetical figure given to the primitive particles of matter. Acknowledging the four elements of Empedocles and Hippocrates, he added a fifth, which he called ether, an immaterial principle which he supposed to move perpetually around the earth, considered as a common centre, This, as is evident, is the first idea of the system of whirlwinds. Like Empedocles, he made all bodies result from the mixture of the elements; but he believed that in the state of combination, they possessed the elementary properties of the principles of which they were composed. Finally, he attributed to the influence of the earth, as the most solid element, the tendency of bodies to be directed towards a common centre, and to fire, as the lightest, and on account of its radiation from the centre to the circumference, every tendency contrary to what we call ponderosity. Do we not here perceive the germ of the theory of gravitation and of the expansive power of caloric?

Hippocrates had demonstrated that experiment is the only means of arriving, in the sciences, at certain results. Aristotle made this principle the foundation of his new philosophy; but to make the application of it, it was necessary to find a more certain course than that of the philosophers who had preceded him, and the following is the train of reasoning by which he arrived at the determination of this course. The mind acquires no knowledge without the intervention of the senses, whose office it is to put the mind in possession of what occurs externally to it. From the facts which reach it in this way, are formed the notions which constitute the sciences. It is necessary, therefore, to commence by observing the natural bodies and the phenomena relating to them; but the senses being liable to error, the mind requires rules for its direction in the midst of the impressions which it perceives: hence, the necessity of subjecting the senses to a good method of observation, and the mind to processes of reasoning which render error impossible. This latter operation constitutes an entire branch of philosophy, of which Aristotle may be considered the creator, and which is called logic.

* According to Pythagoras, fire was of a pyramidal form, air octohedral, water icosahedral, earth cubic, and the terrestrial globe had the form of a dodecahedron. Hence, the doctrine of the five regular solids of Euclid.

These points once established, the philosopher of Stagira conceived the project of reconstructing on a new plan the entire edifice of science. The base of this edifice must be the history of nature. The first thing to be done, therefore, was to collect the materials of the requisite investigations, and prior to Aristotle these materials were very few in number. The preceptor of Alexander taught his pupil that one of the finest trophies of his conquests would be to collect the natural productions of the countries into which he carried his arms, in order to advance the progress of natural history; and Alexander comprehended this. His glorious expeditions having opened to the Greeks the gates of India, Persia and Egypt, and having multiplied their relations with the East, the young conqueror collected, at great expence, in all the countries which he subdued, the natural substances, but more especially the animals which inhabited them, and sent them to Aristotle. According to Pliny, many thousand persons were employed to collect these objects, and we are assured that an enormous sum (about three millions (French?) £120,000 English) were devoted to the purpose.* Aristotle was by this means placed in the most favorable circumstances for enriching natural history with a host of discoveries. Thus, he was enabled to collect an incalculable mass of facts, and he furnishes, perhaps, the only example of a man who, finding science so little advanced, has amassed so considerable a number of observations and has deduced such valuable results from them.

The history of animals is the branch of natural history which owes most to the labors of Aristotle, which he created, so to speak, and to which he devoted himself with most perseverance and success. Before him, this science had no existence. In ancient Greece, zoology was less a study for philosophers than for artists, who sought in it for symbols and emblems, and represented certain divinities under the figure of certain animals which were consecrated to them. Democritus, Empedocles, and a few other anatomists, had studied a small number of

* Alexander did not confine himself to opening to the Greeks the commerce of Egypt and the East; he favored the importation of the remedies of the Levant, and caused the aloes to be cultivated by a portion of his subjects in the island of Socotra; it was only after the foundation of Alexandria that the juice of this plant was employed in medicine, and described by the authors who wrote on Materia Medica.

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isolated beings, but they had viewed nature only in a partial manner, whilst Aristotle established the foundation of a general and complete science. Not only did he penetrate into the details of the history of animals, but he considered the whole of it from an elevated point of view, and made rather the history of the animal kingdom than that of each species: he arranged the facts observed, according to the organs and the functions, and by comparing them with each other, he created the science of comparative anatomy; finally, besides his own numerous researches and observations, he applied himself to correcting a host of errors relative to natural history, which does not go the length of saying that he committed no error himself, but which at least renders them pardonable. Although he is sometimes blamed for his want of method, it is nevertheless certain that he was the first who put in order and spread light among the numerous subjects which he studied. According to Cuvier, the principal divisions which he established in the animal kingdom are retained to this day, and he indicated several to which we have recently been compelled to return, after having improperly given them up for a time. To this homage, paid to Aristotle by one of our greatest naturalists, we may add that of Buffon. "I do not think that it is possible to reduce to less terms all that has been said concerning this matter. It required a genius like his to preserve in it so much order and clearness. This work presents itself to my eyes as a table of matters which might have been extracted, with the greatest care, from several thousand volumes filled with descriptions and observations of every kind. It is the most learned abridgement which has ever been made, and even when it is supposed that Aristotle extracted from all the books of his age that which he put into his own, the plan of the work, its distribution, the choice of examples, the justice of the comparisons, and a certain turn of ideas which I should call the philosophical character, leave no doubt for an instant that he was himself far more richly endowed than those from whom he could have borrowed."

Aristotle wrote two works on plants, entitled *Theory* of vegetables, which have not descended to us. The study of plants having been the subject of his first works, it cannot be doubted that he had an opportunity of making useful discoveries in the vegetable kingdom, which Theophrastus, his pupil did not fail to collect. Linnæus regarded him as a botanist, and dedicated to him, under the name of *Aristotelia* an elegant shrub which grows in Chili.

To be continued.

AGREEABLE SYRUPS FOR EVENING PARTIES*.

BY M. BELLANGUÉ, APOTHECARY TO THE HOSPITALS AT BEAUVAIS.

ORANGE SYRUP.

℞ Portugal oranges with fine skins	200	
Very white dried sugar	32	Kilo.
Citric acid	50	gram.
Alcohol	150	,,

Break about 15 or 16 kilos. of sugar into flat pieces, wipe the oranges and rub them with the sugar to remove all the yellow rind which contains the essential oil, and put the sugar in a large stone pan which is to be covered and put in a cool place.

On another stone pan, place a fine hair sieve (which should be used only for these syrups,) then remove the rinds of the oranges and press about a dozen at a time so as not to leave the pips too long in contact with the pulp.

These two operations will employ two skilful people for about nine or ten hours.

Wash the sieve, carry the pan into a cool place and cover it with the sieve.

After twenty-eight or thirty hours' rest, cut up a sheet of filtering paper and bruise it in a marble mortar, place it on the side of a well washed felt straining bag; then pour in the orange juice by means of a funnel to receive the fall of the liquid.

Two hundred oranges of a medium size give nine kilos. and some hundred grammes.

The amount of filtered juice must be noted and added to an equal portion of the orange syrup.

The next day, the filter being well drained, proceed to the confection of the syrup.

Put into a preserving pan 1,000 grammes of sugar to 600 grammes of orange juice, melt it after mixing well with a wooden spatula, cover it with a stone pan.

Break up the remainder of the sugar and place it in the pan in which was the orange syrup, add the solution of citric acid with its quantity of water in the same proportion of 600 grammes to 1,000 of white sugar.

When the first syrup simmers and the scum has all risen, remove it from the fire, put the scum to the citric syrup, stir it well with the spatula several times whilst waiting for the straining of the syrup.

Place the sieve over the second pan, put in a round piece of filtering paper to receive the fall of the syrup, pour it by means of a colander.

* *Repertoire de Pharmacie*, Sept. 1850.

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Make the second syrup with the same care as the first, manage the fire so as to give time for the sugar to unite with the aromatic principle of the orange; when the sugar is melted and the scum well risen, remove it from the fire, let it stand a quarter of an hour, remove the scum with care, strain the syrup and mix it with the other while warm; put it in bottles, cover them with a white cloth, and cork them the next day, steeping the corks in alcohol.

N.B. The scum infused in brandy will make an excellent orange liqueur.

Prepare in the same manner syrup of lemons and citrons by adding 100 grammes of citric acid more than the amount indicated for syrup of oranges.

These two syrups should be made in the winter, preferably in December or January.

RASPBERRY SYRUP.

℞ Red raspberries..... 6 parts.
Finely pounded white sugar... 5 ,,

Place in an earthen pan a layer of raspberries, then one of sugar alternately, taking care to preserve some sugar to cover the raspberries. Put the pan in the cellar and cover it with a hair sieve; leave it for one or even two days; put it in a deep, wide pan, and place it over a fire, cover the pan, stir it with a skimmer three or four times before it boils; let it boil for five or six minutes; add to each kilogramme of sugar 15 grammes of alcohol, at 24 degrees, and remove from the fire during the great boiling caused by the addition of the alcohol; cover the pan, and after standing for half an hour pass it through a sieve in which you have placed a shield of filtering paper, the same as for the orange syrup.

The general rule for all syrups is to put them in bottles while still warm, and not to cork them until cold, and always with alcohol, which prevents them from becoming mouldy.

RASPBERRY VINEGAR SYRUP.

This syrup not being much in demand, deteriorates and loses its color.

Make a syrup with strong raspberry vinegar, six parts to ten of very white sugar.

Add, if wanted, sufficient raspberry syrup to give it the color, which renders it more agreeable.

GOOSEBERRY SYRUP.

℞ Red gooseberries..... 5 parts.
Freshly gathered acid cherries. 1 ,,

Crush the gooseberries and cherries in portions together. Two had better work at it at once, so that one may press and the other crush without stopping, and the warmth of the hands developes the coloring and aromatic principle which resides in the pellicle of the fruits.

Take the pans, which should be made of earth, into the cellar and cover them with well washed hair sieves. During the space of twenty-eight or thirty hours, take care to divide the pulp two or three times, by means of a stick of white wood split in several directions,* so as to prevent fermentation.

If you have a pan sufficiently large to contain the whole of the juice to be filtered, you can pass it through a bag; but I give the preference to the hair sieve, having very high sides, (15 centimeters at the most,) two sieves will suffice for 50 kilos. of gooseberries and 10 kilos. of cherries.

Put a shield of filtering paper occupying two-thirds of the sieve, and pour on it, through a delft or porcelain colander; the sieve may be filled and the juice will pass through quite clear. The pan must not be changed, for if the juice remains quite still in any vessel, even in full bottles, fermentation takes place very rapidly, and the juice becomes thick; this will not happen should it be dripping into the same vessel for twelve or fifteen hours in the cellar.

To 600 grammes of juice add 1,000 grammes of white sugar broken up, cover the preserving pan, and melt; when it simmers remove it from the fire, skim it carefully, add one-sixth of raspberry syrup and two grammes of alcohol to each kilo. of sugar. Mix the alcohol with a little cold raspberry syrup to prevent too rapid an evaporation; then strain it with the above-mentioned precautions.

Syrup of cherries is prepared in the same manner, likewise adding the raspberry syrup.

SYRUP OF ORGEAT.

℞ Sweet almonds.....	550	gram.
Bitter ditto.....	200	,,
Water.....	3·500	,,
Sugar.....	6·375	,,
Triple orange flower water	150	,,
Alcohol.....	32	,,
Essence of citron.....	8	drops.

Blanche the almonds with boiling water, throw them into cold water, drain them through a sieve, wipe them with a cloth,

* A piece of green hazel-tree wood, barked, of about an inch thick, may be split in six or eight parts, leaving about 25 centimeters, unsplit; put a *fosset* to keep the strips apart, and fix them with packthread. This is far preferable to the osier whisk generally used to beat eggs; it is used by rolling it between the hands.

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dry them in an oven or any hot temperature.

Divide this quantity into six portions, and add to each 125 grammes of sugar, triturate it until the paste is smooth in all its parts, and no sharp pieces can be felt between the fingers.

Put all the portions together and make the emulsion, taking care not to put more than half a wine-glassful of water at a time, strain through a woollen cloth recently moistened with water; wash the cloth immediately after the pressing, lest it should become greasy.

Break the remainder of the sugar which you put into a preserving pan, add the emulsion and mix; put it on the fire, cover the pan and bring it to the simmering point; remove it from the fire, and after standing for half an hour, pour it into an earthen pan and cover it.

When the syrup is cold remove the scum and triturate it in a marble mortar; add the alcohol and citron, then the orange flower water, and decant the syrup from the earthen pan; put the grounds aside, pass it through the same cloth, put it in very dry bottles, and cork with alcohol.

GENERAL REMARKS.

These details have been extracted from my laboratory book; I give them here to assist those who wish to become good practitioners and to quadruple their sale. All these syrups vary according to the manner of making them; but those who understand these matters say that he who makes good syrups, will make good medicines.

This much I can assert, that I have some syrups five years old which are as good as in the first year.

It will be observed that I put less sugar than is prescribed by the pharmacopeias; but I choose very white and well dried sugar, which makes a slight difference in price, and my syrups never crystallise, the small quantity of alcohol suffices to preserve them and never injures them.

ON POISONING BY CERTAIN FISHES.*

THE production of the poison in fishes is according to Dr. Krugelstein, in every way analogous to that of the poison which is developed in black puddings; in both cases the poisonous principle results from the putrifying decomposition of the fat and blood; smoking the fish is favorable to its development, in consequence of the empyreumatic oil contained in the smoke; in the stomach, this decomposition is hastened by the heat of the viscera, and a peculiar gas is then produced of which the presence is betrayed by an odor *sui generis* and analogous to that of the breath of drunkards. The degree of activity of this poison is in inverse proportion to that of the digestion. The effects of this poison are very similar to those of poisoning by *aqua toffana*; the same slow and gradual weakening of the digestive and vital powers, with a perfect preservation of intelligence.

There are three distinct periods in the course of this poisoning.

The first is marked by a general sensation of weakness, repeated vomitings and diarrhœa; at the same time symptoms are observable of cerebral congestion and a great dryness of the nasal and pharyngeal cavities.

The second period manifests itself about two days after the commencement of the malady; obstinate constipation, suppression of all the secretions, the perspiration, the saliva, &c.; the urinary secretion is the only one which continues; this is abundant and micturition is accompanied by cramps. Nevertheless the most remarkable signs are the following:—General emaciation, cessation of the precordial pulsation, a cough similar to that of croup, paralysis of the upper eyelid, inertness and immobility of the iris, dysphagia.

Third period. The preceding symptoms increase gradually until they reach the point of complete aphony and blindness, paralysis of the inferior extremities; the respiratory organs lose their functions, and death takes place tranquilly, generally before the end of the tenth day.

Cures of this kind of poisoning are very slow in being effected. The corpses decompose rapidly without, however, exhaling a putrid odor.

As for the treatment, the first step is to administer emetics, such as ipecacuanha, sulphate of zinc; the second, to disembarrass the intestines by oleaginous saline mixtures and lavements. Afterwards a drink may be given of solution of half a scruple of sulphuret of potassium in a quart of water. (*Henke-Siebert's Zeitschrift*, 1848.)

It will, perhaps, be interesting to compare with the preceding observations, those which M. Autenrieth has given on poisoning with *salt fish*. This kind of poisoning is chiefly met with in Russia, where the sale of salt fish forms an important branch of commerce. This poisoning, which has only lately attracted attention, is marked by nausea, vomitings, a sense of weight at

* *Répertoire de Pharmacie*, August, 1850.

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the epigastrium, and above all by the phenomena of narcotism, such as vertigo, weakness of the sensorial perceptions, stupor, loss of consciousness, &c., finally, death supervenes. Autopsy shows neither inflammation nor congestion, nor any appreciable alteration; the chemical analyses, which have been undertaken in the hope of finding some peculiar poisonous principle, have hitherto proved fruitless. It is only immediately after the poison has been taken that we can depend on the efficacy of the medicines (emetics); we know of no antidote. The poisonous principle is especially found in the salt fish which is eaten *raw*, according to the custom of the country; cooking generally destroys this poisonous principle, but this is by no means always the case. In seeking for the causes which give salt fish its poisonous properties, M. Autenrieth has arrived at the following conclusions:—

1st. It is probable that most fishes contain the poisonous principle before they are salted.

2nd. This principle may readily develope itself between the moment of the catching of the fish and its being subjected to the usual preparations. The high temperature of the south of Russia, the extreme abundance of the fisheries, which is so great that in the Caspian Sea alone, they give employment to about 200,000 men, render this supposition probable.

3rd. A concourse of peculiar circumstances hitherto unknown, must be allowed for to explain the production of a poisonous principle which is always alike, for all we have mentioned merely takes account of the *putrid decomposition of the fish*.

4th. The developement of the poisonous principle cannot be said to be confined to any one genus of fish; nevertheless, the different varieties of the genus *huso* appear to have given rise to the greatest number of cases of poisoning.

5th. The imperfections of the salting processes in consequence of which the salt does not sufficiently penetrate the thick pieces of fish, a defective system of packing which permits the access of the air, bad methods of preserving, are all circumstances which hasten or cause decomposition.

6th. Chemical analyses have, in certain cases of poisoning by salt fish, demonstrated the presence of arsenic, copper, and even of mercury in globules. But these are accidental cases, having no connection with those of which we speak.

7th. The quality of the Russian salt, which is inferior to that of Norway, Holland, and England, must undoubtedly be regarded as the principal cause of the greater ease and promptitude of the decomposition of fish in Russia than elsewhere.

8th. The poisonings of which we speak here result particularly from the use of fish caught in the south of Russia; that in the north is subject to a different species of corruption, which, although injurious, is rarely poisonous.

POISONING WITH HEMLOCK.*

BY DR. BOUCHARDAT.

Cases of poisoning with hemlock are rare. I have lately had occasion to observe an instance at the Hôtel-Dieu. A young woman had, in a moment of desperation, as she said afterwards, swallowed a strong dose of the juice of hemlock, which she had herself prepared, being aware of the poisonous qualities of this plant.

When brought to the hospital, she was unconscious. The only guide I could obtain was this,—"This woman has knowingly poisoned herself with a plant which she gathered in the neighborhood of Meudon."

The eyelids were firmly closed; force was necessary to open them; it was then clearly perceived that the pupils were dilated; respiration, though weak, was performed in a satisfactory manner; the pulse was small and 82. The skin, although not icy, was cold; some slight spasmodic movements were to be remarked in the superior members as well as in the muscles of the face.

I thought that an hysterical attack complicated the effects of the poison. I suspected stramonium, or other poisonous solanum, digitalis or hemlock. In this dubious state, it was certain that the best course would be to cause vomiting, and then, by examining the matters expelled from the stomach, to ascertain the nature of the poison which had been taken. Fearing a decomposition of the emetic, I prescribed a mixture of 1½ gramme of ipecacuanha in powder, and 15 centigrammes of tartar emetic, in three doses, to be administered at thrice with five minutes' interval.

The emetic draught acted thoroughly, the patient vomiting several quarts; the liquid thrown up was slightly green; but after these vomitings she seemed to be going on so well, that I thought it better to wait before prescribing anything further. The improvement was so rapid, that by the evening she was nearly well; and the next day she felt no farther inconvenience from it.

* *Répertoire de Pharmacie*, August, 1850.

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ACTION OF WATER ON LEADEN CISTERNS.*

Lead does not oxidise either in dry air or water deprived of air, but oxidises in water in proportion to the quantity of oxygen it holds in solution; this oxidation is probably facilitated by the presence of nitrates, which are partly reduced by the lead.

The organic substances in water may act in two ways; when they are in a state of suspension, they ferment the disengagement of the air—on the contrary, when dissolved in water, they fix the oxygen in solution, and may even reduce a portion of the nitrates or sulphates present.

The infusoria which are oftentimes found in water, and which disengage oxygen, abound especially in warm weather—consequently the waters exercise only a feeble dissolving action on the oxygen of the atmosphere.

The alkaline chlorides contained in water attack lead only when these waters are deprived of air. Generally speaking, the presence of salts diminishes the action of water on the lead, inasmuch as they weaken the affinity of the water for air and saline substances.

Lead is covered with a more or less thick coating in all waters; sometimes this layer or coating is formed of a suboxide of lead, insoluble in water and saline solutions. At other times, the coating is due to a higher oxide, which in uniting with water, and carbonic acid, forms a combination, soluble in from seven to ten-thousandths of its weight of pure water. Sometimes this coating contains sulphuric and other acids. When these substances, by means of organic matter and sesquioxide of iron, they constitute an effectually protecting shield.

ON THE BEST MANNER OF ADMINISTERING IODINE—USE OF IODIDE OF STARCH.†

BY DR. QUESNEVILLE.

The interesting memoir lately published by M. Chatin should attract the attention of medical men to the important part that iodine plays in medicine. According to M. Chatin, in fact, iodine is to be found in nearly all soft waters; it exists in plants, in terrestrial animals, in fermented liquors, wine, cider, perry, in milk and in eggs. It forms a part of arable earth, and its presence, in a word, is almost universal in all the aliments used by man.

When iodine is absent from the waters of certain springs and of certain countries, it is remarked in these countries that the inhabitants are more unhealthy and have a peculiar predisposition to scrofula and goitre. The water from wells, always so unwholesome, does not contain nearly as much iodine as soft water, and the water proceeding from the liquefaction of snow is totally without it. These observations, supported by between five and six hundred analyses, are most important, and should be taken into serious consideration by medical practitioners.

Reflecting on all these facts, we asked ourselves under what form iodine could be administered in medicine; we then remembered that many years ago we recommended the use of soluble iodide of starch to some scrofulous patients, and that the cure had been remarkably prompt.

Combined with a body like starch, so easily assimilated with the other digestive principles, iodine is liberated immediately on its arrival in the stomach, and thus disengaged from its combination.

It then acts as iodine would act were it administered in the pure state and not combined with alkalis or metals which cause the loss of a portion of its virtue.

M. Huette proposes the use of hydriodic ether, which he advises to be inhaled by the patients. This means is without doubt most ingenious, and may render great services in certain exceptional cases.

Whilst trying to reproduce soluble iodide of starch, we remarked that sugar heated for some time with the iodide of starch, precipitated as a paste, combined with it perfectly, and that the syrup which is obtained from it was of a very deep blue color and perfectly transparent; this, then, will enable us to prepare a syrup with the iodide of starch.

Wishing to know in what proportions this syrup of iodide of starch can be prepared, we have made it ourselves, and have obtained the proportions of 12 grammes of iodide of starch to 1 kilogramme of syrup, which represents, according to the composition of iodide of starch, 5 grammes of iodine to each kilogramme, or ½ per cent. When it is wished to give iodine in small doses, to order it for children for example, to susceptible systems, or to stomachs already irritated, nothing can be better than the soluble iodide of starch. It thus replaces successfully the cod-liver and skate-liver oils. In giving large doses of iodine, as the syrup, if taken in too great quantity, becomes disagreeable, it can be replaced by powder of iodide of starch, which will be

* *Patent Journal.*
† *Revue Scientifique.*

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given like rhubarb, made into pills or simply mixed in water. These powders contain, combined with an excess of starch, 10 per cent. of iodine; they are perfectly washed in boiling alcohol in order to deprive them of all excess of iodine which would be dangerous.

Iodide of starch can be taken in very strong doses without irritating the stomach or intestines; it acts much more readily than the other compounds of iodine, and should be preferred to them in most cases.

POTASSIO-TARTRATE OF IRON AND ITS PHARMACEUTICAL PREPARATIONS.*

BY M. MIALHE.

Its scarcely perceptible ferruginous taste permits it to be taken by those stomachs which can least endure the salts of iron; and, as by its chemical nature it produces neither precipitation nor astriction, it will not, even if administered daily and in large doses, give rise to the obstinate constipation or painful irritation of the digestive tube, which so frequently impede the use of other ferruginous preparations.

If, in some cases, it has caused diarrhœa, it was in consequence of its being impure, and such as will often be found in the drug trade; it then contains a large proportion of cream of tartar, and constitutes rather a purgative than a really ferruginous preparation

To obviate this serious inconvenience, it is indispensably necessary that every pharmaceutist should prepare his own potassio-tartrate of iron, by causing an excess of hydrate of peroxide of iron to react on a sand bath on cream of tartar diluted with six times its weight of water. As soon as saturation is complete, which is known by the deep red color acquired by the liquor and its sweetish flavor, it is filtered through paper, the saline solution is placed in plates and dried in an oven. The potassio-tartrate of iron should be used in this pure state.

M. Mialhe has generally adopted the following formulæ.

PILLS OF POTASSIO-TARTRATE OF IRON.

	gr.
Potassio-tartrate of iron	25
Gum syrup, about	5

F. S. A. 100 silvered pills, which, weighing 30 centigrammes each, will contain 25 centigrammes of potassio-tartrate.

SYRUP OF POTASSIO-TARTRATE OF IRON.

	gr.
R. Potassio-tartrate of iron	16
Cinnamon water	16
Simple syrup	500

Dissolve the potassio-tartrate of iron in the cinnamon water, filter the solution, add the simple syrup and agitate so as to cause a perfect mixture.

Although this syrup contains a great deal of iron, 1 gramme of salt of iron to 30 grammes, its taste is not disagreeable, and it is taken readily by children.

Finally M. Mialhe gives a new preparation of lozenges, which children or the most fastidious persons may take without repugnance.

LOZENGES OF POTASSIO-TARTRATE OF IRON.

	gr.
R Powdered sugar	1000
Potassio-tartrate of iron	50
Powdered gum tragacanth	10
Vanilla syrup at 8°	30
Water	100

F. S. A. into a homogeneous paste and divide into 1000 lozenges, each of which will contain 0·05 centigramme of potassio-nitrate of iron.

* *Bulletin de Thérapeutique.*

ON AN APPARATUS FOR THE PREPARATION OF THE JUICES OF FRUITS BY STEAM.*

BY M. MAYET.

The preservation of the juice of fruits by Appert's process is now almost universal. By this means we avoid making at first, a great quantity of syrups, which, if preserved for a long time, form crystals of grape sugar in the vessels containing them.

The process which I have hitherto employed to heat the bottles consists in surrounding them with straw, and placing them in a preserving-pan with water, which is made to boil.

I have this year prepared my juices by a method which appears to me to have many advantages over the foregoing, and I think it will be easily followed by those pharmaceutists who have an alembic with the modification recommended by M. Soubeiran for distilling by steam; for it is with this apparatus, without any alteration to speak of, that I have made all my experiments. I operate in the following manner: I put four, or at the most five, quarts of water into the cucurbite; I apply the water-bath, and re-

* *Journal de Pharmacie et de Chimie*, September, 1850.

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place the head, by a simple cover pierced with a hole of three centimetres in diameter, into which I fix, by means of a cork, a thermometer; upon the diaphragm I extend a woollen cloth, so that the steam shall pass equally over all, and the bottles which are nearest to the pipe shall not be broken; I place the bottles, prepared and tied down as usual, by the side of each other, but not quite to touch; I then, with pasted paper, lute every joint of the apparatus, and heat until the thermometer reaches 183° F.; I then suffer the temperature to lower to about 104°, before removing the bottles to replace them by others, and to recommence the operation. Should the water-bath have no cover adjusted to it, the ordinary head to the alembic may be used; but, in this case, the conductor must be corked where it opens into the worm, and the thermometer is placed in the upper tubulure.

This process appears to me to offer the following advantages: it is quicker and more economical, because there are only a few quarts of water to heat; it requires less care, for it is unnecessary to wrap each bottle in straw; and when the apparatus is sufficiently cool to admit of exposing the bottles to the air, without fear of breaking them, it is sufficient to unlute the cover to commence another operation immediately, merely taking care to keep sufficient water in the still; finally, the loss of bottles is less.

I thought at first that, if some bottles broke, the contents could still be preserved, but a small quantity of condensed steam which would mix with it in the water-bath must alter the quality of the juice; still, when this process is applied to the preservation of fruits, should some bottles break, these may be collected on the diaphragm, and they will have sustained no change.

It is evident that this apparatus cannot equal in perfection those used for the preparation of alimentary preserves on a large scale; still, as it is simple, and within the reach of all pharmaceutists, I have imagined that I should be doing them a service by proposing the use of it to them.

ON AN APPARATUS FOR FILTRATION WITH HEAT.*

PRESENTED TO THE "SOCIETÉ DE PHARMACIE," BY M. DUBLANC.

THIS apparatus, invented by M. Septier, tinman, is a clever application of the system of Lamare for heating liquids by the flame of alcohol. It is composed of a tinned iron funnel with double walls, having in the upper part an opening to introduce water into the interior. Outside the funnel, near the socket, is a small cistern to contain the alcohol. Its capacity is in accordance with the quantity of alcohol necessary, so that the heat produced by its combustion may heat simultaneously all the water contained in the funnel. A cone or funnel of iron is placed in the interior, to receive the filtering paper or other tissue for a similar purpose; it is intended to prevent the juxtaposition or adherence of the filtering tissue to the internal surface of the funnel. There is likewise above a cover for the aperture.

The advantages of this little apparatus depend entirely on its combination. Double funnels have been long known, both of tin and of porcelain; but their use requires an amount of water which costs a good deal to heat. With M. Septier's funnel, the water is heated with but little alcohol, of which the price is unimportant,* and is warmed again with even a smaller quantity.

In pharmacy, the operations in which are almost always in small quantities, the usefulness and economy of this apparatus will be evident, either for filtering fats, or to perform displacement by continued heat.

* *Journal de Pharmacie et de Chimie*, September, 1850.

* The cost would not be unimportant in England, when the duty on alcohol constitutes a serious impediment to manufacturing operations.

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"A. B. C."—You are quite wrong in supposing that any good can be expected from that source.

"M.P.S.G.B."—We shall be happy to lend you all the aid in our power.

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON THE SEPARATION OF THE ALKALIS FROM MAGNESIA, AND ON THE ANALYSIS OF THE ALKALIFEROUS MINERALS.*

BY M. EBELMEN.

THE separation of magnesia from the alkalis is one of the most delicate operations of chemical analysis. It is commonly effected at the end of the analysis; and, in the case of silicates unattackable by all the acids except hydrofluoric acid, the three bases which it is required to separate are almost always in the state of sulphates. It is customary to separate the magnesia and to convert the potassa and soda into chlorides, in order to be able to estimate the potassa in the state of platino-chloride of potassium.

The means most generally employed for effecting the separation is that pointed out by Berzelius. The sulphates dissolved in water are treated by an excess of acetate of baryta, in order to convert the three bases into acetates. The liquor is filtered and evaporated to dryness, and the residue calcined at a red heat, in order to convert the acetates into carbonates. On redissolving in boiling water, the carbonates of potassa and soda alone are dissolved, leaving the magnesia and carbonate of baryta, which are separated by redissolving in hydrochloric acid, which dissolves both of them, precipitating the baryta by sulphuric acid, then evaporating the filtered liquor, in order to estimate the magnesia in the state of sulphate. As regards the alkaline carbonates, it is easy to convert them into chlorides, in order to separate the potassa by means of chloride of platinum.

I have employed this process in the analyses of a very great number of alkaliferous rocks. It occupies a very long time, moreover the sulphate of baryta arising from the precipitation by the acetate, filters extremely slowly, and the liquor always passes through turbid, even when heated, and when acetic acid is added to it. Hence it results that in calcining to dryness the product of the evaporation, and afterwards redissolving the matter in water, the alkaline carbonates which are obtained always contain a considerable proportion of sulphates, a circumstance which impairs the accuracy of the estimations and prevents the separation of the potassa by the chloride of platinum.

I endeavored in the first place to simplify the operation and to render it more accurate by putting into the solution of sulphates of magnesia, potassa and soda, artificial carbonate of baryta in powder. I found that carbonate of baryta completely precipitated magnesia in a hot liquor, but that it did not completely convert the alkaline sulphates into carbonates. There always remains in the liquor, whatever may be the excess of carbonate of baryta, the state of dilution or the temperature of the liquid, a considerable proportion of sulphuric acid. This fact, moreover, is very easily explained. It is known, indeed, that the alkaline carbonates in solution have the property of decomposing the insoluble sulphates, such as those of baryta or strontia, more or less completely, according to the relative proportion of carbonate and sulphate in contact. It may be conceived, therefore, that the presence of a certain quantity of alkaline carbonate formed by the reaction of the carbonate of baryta on the soluble sulphate would have the effect of preventing the total decomposition of the alkaline sulphate.

* *Annales de Chimie et de Physique*, Nov. 1850.

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But if we act simultaneously on the solution of the sulphate, with carbonate of baryta and a current of carbonic acid, a period soon arrives when the liquor contains carbonate of baryta dissolved in the state of bicarbonate, and no longer retains any sulphuric acid. The alkalis are then completely converted into bicarbonates, and then exist in the liquor with a small quantity of bicarbonates of magnesia and baryta. They are easily separated by filtering the liquor, evaporating to dryness at a sufficiently high heat to reduce all to the state of neutral carbonates, then redissolving in a very small quantity of boiling water, which then dissolves only the alkaline carbonates, without magnesia or baryta.

It is easy, moreover, to ascertain that sufficient carbonic acid has been passed into the alkaline liquor. A few drops are put on a very small filter, and the filtered liquor is tested by adding a drop of very dilute sulphuric acid. When it is turbid, we may be sure that the liquor contains no more sulphate. This test sample is returned to the principal liquor, and the whole is filtered: the filtration takes place with great rapidity.

The employment of carbonate of baryta presents this additional advantage over the acetates, that the product of the evaporation to dryness, being not very bulky, a very small quantity of water is sufficient for completely dissolving the alkaline carbonates without removing either baryta or magnesia in considerable proportions. It is otherwise when the acetate is employed. The product of the calcination ordinarily contains much carbonate of baryta, a very great quantity of water is required to wash it completely, and this circumstance allows a small quantity of magnesia to be dissolved.

The following are the experiments which I made to determine the accuracy of the process which I have just described:—

I. I dissolved in water;—

	grammes.
Crystallised sulphate of potassa heated to redness	0·547
Crystallised sulphate of magnesia	1·930

I added about 200 cubic centimetres of water and 10 grammes of carbonate of baryta obtained by precipitating the chloride of barium by carbonate of ammonia, washing with care and drying the precipitate at a gentle heat. The liquor was boiled, then allowed to cool, and a current of carbonic acid passed in until the solution was rendered turbid by a drop of very dilute sulphuric acid. It was filtered, evaporated to dryness, and the residue heated to dull redness, and then redissolved in a small quantity of boiling water and filtered. The alkaline carbonate was saturated with hydrochloric acid. I obtained:—

	grammes.
Dry chloride of potassium	0·4640
According to theory, I should have obtained ..... (S=200, Po=487·5, Cl=443·5)	0·4677

The loss therefore was gr. 0·0037, or only 0·8 per cent.

The chloride obtained was completely redissolved in water, with the exception of a few imponderable flocks. The liquor did not precipitate with either sulphuric acid, chloride of barium, or phosphate of ammonia and ammonia.

II. I mixed as in the foregoing experiment:—

	grammes.
Sulphate of soda resulting from gr. 0·515 of dry chloride of sodium	
Crystallised sulphate of magnesia	1·260
Dry carbonate of baryta.....	10·000

I obtained

	grammes.
Dry chloride of sodium	0·508
Loss	0·007

(or 1·4 per cent).

The chloride of sodium was absolutely pure; it contained neither sulphuric acid, magnesia nor baryta.

These two experiments demonstrate the accuracy of the process described, since the alkalis was obtained in the state of very pure chlorides, and with only an insignificant loss.

I tried to employ the same means for arriving at an accurate and rapid determination of the alkalis contained in minerals unattackable by acids of ordinary strength.

When we have to analyse a silicate attackable by hydrochloric acid, we ordinarily divide the analysis into two distinct operations; in the first, the mineral is acted on by the alkalis in a silver crucible or by the alkaline carbonates in a platinum crucible; the fused mass is redissolved in hydrochloric acid, add the silica and the other bases, then the other bases, such as alumina, the oxides of iron and manganese, lime and magnesia are successively separated. To estimate the alkalis, we act specially on the mineral, either by means of carbonate of baryta by the dry way, or by means of hydrofluoric acid. In either case, we obtain the base in the state of sulphates, because it is necessary, in the first place, to get rid of the baryta with sulphuric acid, and, in the second, to expel the hydrofluoric acid with sulphuric

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acid. We then precipitate successively by ammonia, hydrosulphate and oxalate of ammonia, then evaporate to dryness and calcine the residue to free it from ammoniacal salts. A mixture of sulphate of magnesia and alkaline sulphates is finally obtained, which may be separated as we have just seen: but it must be remarked that the decomposition of the sulphate of ammonia by heat, is very tedious, and that it is difficult to avoid loss by projections.

I considered that the determination of the alkalis might be greatly simplified by operating in the following manner: the silicate is treated by hydrofluoric acid, then by sulphuric acid, as in the ordinary way. The solution of the sulphates is treated directly by the carbonate of baryta and carbonic acid. It is filtered when the sulphuric acid is completely precipitated, and the solution of the alkaline bicarbonate is evaporated to dryness, operating as I have already pointed out. This process must be most expeditious and enable us to estimate the alkalis which the silicate contains very rapidly. I made some experiments to verify its accuracy.

III. I weighed

	gr.
Pure alumina converted into sulphate	0·580
Dry sulphate of potassa	0·614
Crystallised sulphate of magnesia	0·580

10 grammes of carbonate of baryta were employed.

I obtained:—

	gr.
Chloride of potassium	0·4790
Theory indicates	0·5249

The loss of alkali was therefore gr. 0·459, or 8·7 per cent. The chloride of potassium obtained was perfectly pure.

	gr.
IV. Alumina (converted into sulphate)	0·420
Dry sulphate of soda	0·414
Crystallised sulphate of magnesia	1·000
Sulphate of baryta employed	10·000

I obtained:—

	gr.
Chloride of sodium	0·332
Calculation gives	0·341

The loss therefore was gr. 0·009, or 2·5 per cent.

	gr.
V. Alumina (converted into sulphate)	0·50
Dry sulphate of potassa	0·598
Carbonate of baryta	10·000

I obtained:—

	gr.
Chloride of potassium	0·391
Calculation gives	0·449
Loss	0·058

(or 12·9 per cent).

VI. Alumina	0·50
Sulphate of potassa	0·528
Crystallised sulphate of magnesia	2·00
Carbonate of baryta	12·00

I obtained:—

	gr.
Pure chloride of potassium	0·422
Calculation gives	0·451
Loss	0·029

(or 6·4 per cent).

From these experiments it is evident that we do not obtain all the alkalis when alumina is precipitated by carbonate of baryta: a considerable portion is retained by the precipitate; the loss amounted, in one experiment, to more than one-tenth of the quantity contained. It may be remarked that the soda was almost entirely obtained. The presence of a rather considerable proportion of magnesia appears also to have the result of facilitating the separation of the potassa from the alumina; still the reaction was never complete.

Much more satisfactory results are obtained when we act gradually with ammonia or carbonate of ammonia and baryta. We commence by precipitating the liquor which contains all the bases in the state of sulphate by ammonia or by the carbonate of ammonia. The alumina is precipitated with the peroxide of iron and a portion of manganese and magnesia. The liquor is filtered and boiled with carbonate of baryta in excess, which completely decomposes the sulphate of ammonia. When the addition of a new quantity of carbonate of baryta in powder produces no more disengagement of carbonate of ammonia, the liquor is treated by carbonic acid, operating as I have already indicated. The decomposition of the sulphate of ammonia by the calcination is thus prevented. The estimation of the alkalis is rendered more simple and accurate by it.

The following are the details of two experiments made in order to verify this method.

	gr.	gr.
VII. Alumina	0·50	0·50
Dry sulphate of potassa	0·50	0·50
Crystallised sulphate	0·00	1·50

The alumina was treated by concentrated sulphuric acid, and the sulphate was evaporated to dryness, then redissolved by boiling water; the other sulphates were

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added to it, and the liquor precipitated by an excess of carbonate of ammonia. The gelatinous precipitate was filtered and washed. The liquor was boiled to drive off the excess of crabonate of ammonia, then carbonate of baryta in powder was added until the ammoniacal odor was no longer manifested. The cooled liquor was afterwards treated by carbonic acid, and there was obtained —

	gr.	gr.
Pure chloride of potassium	0·419	0·422
Calculation gives	0·4275	0·4275
Loss	0·0085	0·0055
Per cent.	2·0	1·3

It is evident that the differences between the results of experiment and those which might have been obtained are not very considerable, and of the order of those which are presented in good processes of analysis. I think that it may be employed with confidence in the analysis of the silicates and alkaliferous rocks, and that it is of a nature to ensure at once accuracy and celerity in the determination of the alkalis which they contain. I have just employed it in the analysis of several rocks used in the manufacture of porcelain in China, and the results which it furnished have appeared most satisfactory.

ON THE EXPLOSIVENESS OF NITRE, WITH A VIEW TO ELUCIDATE ITS AGENCY IN THE TREMENDOUS EXPLOSION OF JULY 1845, IN NEW YORK.*

BY ROBERT HARE, M.D., EMERITUS PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF PENNSYLVANIA, AND ASSOCIATE OF THE SMITHSONIAN INSTITUTION.

AMONG the conflagrations by which cities have been more or less devastated, there has been none, it is believed, of which the phenomena were more awful and mysterious than those of the great fire which took place in the city of New York, on the 19th of July, 1845.

2. The destruction of 230 houses containing merchandise amounting in value probably to 2,000,000 of dollars, made the calamity in question highly deplorable as a cause of pecuniary loss and embarrassment; while the characteristics which gave to it an unprecedented rapidity of extension were of a nature to excite an enduring interest as well as temporary consternation.

3. A series of detonations, successively increasing in loudness, were followed by a final explosion, of which, agreeably to an affidavit, the report resembled a "*loud clap of thunder.*" This tore into pieces the building within which it took place, threw down seven houses in the vicinity, and drove in the fronts of the houses on the opposite side of the street, at the distance of 87 feet. The whole of the space within which these tremendous effects took place, was filled with a dazzling flame, and various masses, intensely ignited and vividly luminous, were projected aloft as if expelled from a volcano, so as, on alighting, to spread the conflagration far and wide. Shipping anchored in the Hudson River, probably at the distance of more than a quarter of a mile, were greatly endangered by these deflagrating missiles.

4. So violent was the atmospheric concussion, that people were prostrated by the consequent blast, when too remote to be injured by the flames or flying fragments. Some persons were wounded or killed, but so small was the number, in comparison with that of the multitude which might have been mutilated or destroyed, that there was more gratulation for the escape of the many, than sorrow over the few who actually perished. This comparative immunity was due to the warning given by the detonations, which, as already mentioned, preceded that by which the mischief was effected.

5. The natural inference arising from the detonations thus alluded to, was that gunpowder had been stored in parcels of various amounts on the different floors of the store, the smaller portions above, the larger below, and that the detonations were the consequence of the successive ignition of the parcels thus situated. The cry of gunpowder was raised on the occurrence of the first explosion, and caused the retreat of almost everybody near the quarter whence it proceeded. Hence, before the final catastrophe, the streets about the store were entirely vacated, so that scarcely any person was injured besides those in the houses opposite to the conflagration.

6. Notwithstanding the reasonableness of the belief at first created as to the agency of gunpowder, there was the most conclusive evidence, so far as the oaths of worthy and well-informed witnesses could avail, that no gunpowder was contained in the building within which the explosions occurred. Of course, the real cause of the disaster became a subject of perplexing consideration for chemists in general, and especially for those adepts in chemistry, to whom the

* Presented by the author to the Smithsonian Institution.

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Corporation of the city concerned applied for an elucidation of the mystery.

7. It was fully established by the statements of the highly respectable proprietors, and that of their storehouse clerk, that there were in the store more than 300,000 pounds of nitre, secured in double gunny bags, containing 180 pounds of nitre each, in piles alternating with heaps of combustible merchandise; yet as, agreeably to ordinary experience, such combustibles deflagrate when ignited with nitre, without exploding, this did not remove the unfavorable impressions unjustly created respecting the occupants of the store. The stowing of any large quantity of gunpowder adequate to the effects produced, had been culpably imprudent and illegal; and coupled with a most solemn denial on their part, would have involved them in the baseness of falsehood, if not the guilt of perjury.

8. To everybody the elucidation of the mystery was desirable, since, without a correct knowledge of the causes, the proper means of guarding against the recurrence of such explosions could not be devised. It was interesting to men of science to have it ascertained wherefore their efforts to produce an explosion by similar ingredients were unsuccessful.* To the occupants of the store it was important, since they were liable, not only to ill opinion and legal persecution as above stated, but likewise to a deprivation of their claims for insurance. Fortunately for them, in opposition to the opinions and experimental inferences of several chemists who were consulted, tending to extend or confirm the idea, that gunpowder, illegally and most culpably stored, must have been the cause of the catastrophe, the opinions of Silliman and Hayes, and other eminent chemists were called forth, tending to sanction the inference that the result might be due to the reaction of nitre with contiguous merchandise.

9. I owe it to my friend, Augustus A. Hayes, to state, that I might have adopted the more general impression, had it not been for his inferences and experiments made with the view of accounting for the explosion of a vessel, loaded with nitre, while lying at anchor in the harbour of Boston. It was ascertained by this able chemist, that when, by an experiment made in his laboratory, between 100 and 200 pounds of nitre, intensely heated in a crucible, were suddenly sprinkled with water, an explosion ensued.*

This statement of Dr. Hayes caused me to recollect, that upon one occasion a mischievous explosion had occurred in my

* With means furnished by the Councils, five eminent chemists made several experiments upon a large scale, in order to ascertain the effect of igniting nitre with such combustibles as were associated with it in the store of Messrs. Crocker and Warren; yet in no instance could they produce detonating reaction. The activity of the combustion never surpassed that degree of rapidity and consequent violence which may be designated by the word deflagration.

* The subjoined quotation from the Boston Daily Advertiser, will serve to show the point to which Mr. Hayes had attained in elucidating the mysterious explosions produced by incandescent nitre, when my efforts to afford a further elucidation commenced.

Roxbury Laboratory,
28th July, 1845.

Dear Sir,—Your note of yesterday, in relation to the explosive action of saltpetre, has this moment come to hand. I most cheerfully comply with your request in placing before you the facts connected with the subject of the action of saltpetre on substances usually called combustible.

Saltpetre, or the nitrate of potassa or soda, *alone* does not burn or explode by heat, however intense. It parts with one of its constituents, oxygen, by heat, and it is to the combination of its oxygen with other bodies that it owes its power of burning with them. Wood and other fibrous substances do not burn with saltpetre until they have become partially charred; they then produce *deflagration*, or burn with sparks. A large quantity of saltpetre, enclosed in gunny bags, as it is usually stored, after fire was communicated to it, would burn with the bags, emitting much smoke and sparks, precisely as paper which has imbibed saltpetre would. It would not be consumed; only the small quantity required to burn with the bags would be changed. If an addition of burning wood or charcoal were made to the extent of one-fifth the weight of the saltpetre, an intense and continued deflagration would result, and all the saltpetre would be changed. *No explosion would follow from applying fire to mixtures of charcoal, or wood and saltpetre;* the rapid combustion called deflagration would be produced, but, unlike explosion, time would be required for the mutual actions, and where the quantities were large, many hours would be necessary before they would cease. The recent destruction of life and property in New York, the loss of a homeward bound Indiaman and her cargo, by a similar cause, have

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laboratory, when a fissure taking place in an iron alembic, holding about twenty pounds of fused nitre, on hoisting the alembic off the fire, a jet of the liquified salt fell accidentally upon some water in a tub, which was unfortunately too near. It

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created an anxiety which has led to many inquiries respecting the origin of the *explosions* attending the burning of saltpetre. I need not remind you of a case which occurred at Central Wharf, about ten years since, when the Hartford Packet was destroyed. The testimony obtained in the last instance led me to make some experiments on the effects produced by dropping water on a burning mixture of saltpetre and charcoal. It was ascertained that a very small weight of water, relatively to the saltpetre, caused explosions, which might be made successive, so long as the materials remained. The quantities of the substances acting being increased to between 100 and 200 pounds, the addition of water in the form of spray, caused an explosion which destroyed the vessel and shook all the buildings in the vicinity. The temperature of a burning mixture of saltpetre and charcoal, at the points of contact, is superior to that of "white hot" iron, and the form is that of a bubbling fluid. Water falling on the mass is instantly converted into steam, having the elastic force of that used in steam-guns; exceeding gunpowder in destructive energy. The red-hot particles, dispersed by the sudden action, pass over considerable spaces, and the appearance of flame is produced.

In cases where water falls on highly heated polished surfaces, such as melted glass, copper, or silver, steam is formed rapidly, but silently; the water does not touch the hot surface. The spreading of a film or crust over the polished surface instantly alters its relation to water, and causes steam to form with explosive violence, attended by a loud report.

I do not hesitate in expressing my belief, that the disastrous effects produced in New York were caused by water or other fluid falling on saltpetre, while burning with the bags investing it. The facts which I have stated may have interest or importance in connection with attempts made to extinguish fire in buildings containing saltpetre. The danger of throwing water on the fire is manifest, while the loss to the owner of the saltpetre would doubtless be greater from water than from fire.

Respectfully,
A. A. HAYES.

Henry Williams, Esq.

also brought to mind that potassium, when thrown upon the surface of water, is, by combustion with the oxygen of that liquid, converted into a fused globule of red-hot oxide, which, in the act of combining with water, detonates violently. This detonation struck me as being clearly owing to a sort of double reaction, in which, while one portion of water, by uniting with the oxide of potassium, converts it into hydrate of potassa, another portion, uniting with the heat, flies off explosively as steam.

10. In a letter to Hayes, immediately after his explanation appeared, I stated these facts and inferences; and moreover, I endeavored to illustrate the subject by referring to the explosion so frequently produced by blacksmiths, through the forcible contact with moisture, of incandescent iron struck by a hammer. It has been ascertained that globules of oxide of iron, as they fall in a state of fusion from a wire ignited in oxygen, do not at first produce any commotion in water. This arises from the generation of a protecting atmosphere of rarefied aqueous vapor, which renders contact with the liquid water impossible. Widely different would be the result, were the liquid suddenly forced into contact with the globule by a blow from a hammer, as above mentioned. Analagous causes operate when globules of the most volatile liquids or solids are retained for a time in the cavity of an incandescent metallic ladle, meanwhile evaporating much more slowly than if the temperature were less. In any one of those instances an explosion would follow from a contact being coerced between the heated surface and the liquid. When a hammer is employed as above described, mechanical force produces that contact, which, in the explosive union of incandescent oxide of potassium with water, is caused by intense chemical affinity.

11. The explosion produced by Hayes, as above mentioned, and that which took place in my laboratory, as well as the explosive reaction of oxide of potassium with water, gave a practical confirmation to the inference, that the meeting of water with the base of incandescent nitre could cause tremendous results. Subsequently, in the winter of 1845-46, I found that when nitre, by the flame of a hydro-oxygen blowpipe supplied with atmospheric air and oxygen, is heated to incandescence, and then quickly submerged in water previously situated beneath the containing ladle, a sharp explosion ensues. I found, nevertheless, that when thrown, under like circumstances, upon molasses or sugar, the effects were those of deflagration rather than ex-

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plosion. Yet, latterly, I have fallen upon contrivances. by which pulverised sugar and nitre may be made to explode. The first expedient which succeeded, was that of pouring melted sugar upon the face of a hammer, so as to make a disc of commensurate size. Such a disc, if it should not adhere, is easily made to do so by slightly moistening the face of the hammer. Some nitre was put into a thin shallow platina capsule, situated over a small anvil, near one of its edges, so that the bottom of the capsule might be reached obliquely by a hydro-atmospheric blowpipe flame. Under these circumstances, the nitre having been heated until its potassa began to be volatilised, was struck with the sugar-faced hammer. A smart detonation was the consequence. This experiment may fail sometimes from the blow not being properly given; from the nitre not being sufficiently hot; or the capsule being ill-situated. The explosion of fulminating mercury by a hammer fails sometimes, from the blow not being so given as to produce a due degree of parallelism between the surfaces.

12. Another method of producing explosive reaction is as follows:—Nitre and sugar being coarsely powdered, let discs of paper about 3 inches in width be prepared. Place one of the discs upon an anvil, and cover it with a stratum of sugar. Then cover the sugar with a stratum of nitre, placing over this another of the discs. Heat a flat iron bar, wider than the discs, to a welding heat, and quickly withdrawing it from the fire, and holding it above the paper, strike it down thereon with a sledge. An explosion will ensue, with a very loud report. Of course the operator's face should be protected by a mask, his hands and legs by a leathern or woollen apron and gloves. The operation may be performed by one person, but more advantageously by two, as it is difficult for one to hold the iron in the position most suitable for bringing the surfaces together with the requisite degree of parallelism.

13. In a letter in reply to one from Mr. Durant, of New York, respecting the explosions which are the principal objects of these communications, I adverted to the superiority of the affinity which exists between nitric acid and the same base* as a reason why the presence of the elements of water, or of hydrogen in union with carbon, should, on ignition with nitre, give rise to explosive reaction. Obviously, the consequence of the displacement of nitric acid by water must be, that the gaseous constituents of the acid, incapable of remaining in combination without a base, would escape either as nitrogen, nitric oxide, or oxygen

* It may be well here to advert to the fact, that one of our young countrymen, Tilghman, has, without any hint from me, not only perceived the property of water on which I have insisted, but likewise has had the sagacity to suggest its application to various useful processes. These have all been founded on that superior affinity of water for certain bases, on which, in my letter to Hayes, I had insisted as affording the rationale of the explosion of nitre either with this liquid, or with any substance containing its elements.

From the preceding suggestions, and some experiments, of which an account will be subjoined, it appears that the explosive violence of a mixture of nitre with substances containing carbon in union with hydrogen, or with hydrogen and oxygen, so as to be competent to convert the base into a hydrate or carbonate, is dependent on the force with which they may be held or brought together in a state of ignition, being sufficient to permit of that increase of temperature which is necessary to explosive reaction.

Probably at the temperature thus alluded to, the ingredients are all in a condition analogous to that of a very dense explosive gaseous mixture. It is well known that such mixtures detonate with a velocity apparently not less than that of an electrical discharge. A single electrical spark, a particle of platina sponge, even a sunbeam, may cause an explosion so instantaneous, that it is the collapse only that can be observed. The dilatation which precedes the collapse escapes scrutiny. However large the volume, ignition in any one part seems to affect the whole at once.

I infer, then, that when nitre and certain compounds of carbon with hydrogen and oxygen reach a temperature at which the whole mixture, if not restrained mechanically, would take the aëriform state by a sudden revolution in the electrico-chemical polarities, that detonating combination ensues, to which, when ignited, various gaseous mixtures are liable. A few cubic inches of olefiant gas, with twice the bulk of oxygen, included in soap-bubbles and inflamed, will produce a report equal to that of a musket. The accidental explosion of a half-gallon of a similar mixture created a thundering noise like a field-piece, so as to alarm the whole neighbourhood within a furlong of my laboratory.

Aware of the influence of confinement in augmenting the force of reaction between nitre and combustibles, the distinguished

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gas, or, carbon being present, partially, as carbonic oxide or carbonic acid.

14. Gum, sugar, starch and lignin, consist of carbon in union with the elements of water, being virtually hydrates of carbon. Oils, resins, or bitumens, consist of carbon and hydrogen, with but little oxygen. Of course either, when heated with nitre, can supply water to the base of this salt, *with*, if not *without*, assistance from its oxygen, which constitutes nearly half of the matter in nitre. Such substances may, therefore, under favorable circumstances, perform the part performed by sulphur in gunpowder, which I conceive to be that of seizing the potassium and liberating the acid, so as to enable its oxygen to react freely with the carbon and the resulting sulphide of potassium. Considerations analogous to those advanced respecting the agency of the elements of water in exploding with nitrates, will apply with respect to those of carbonic acid; since carbonated alkalies, no less than the hydrated, being indecomposable *per se* by heat, carbon as well as hydrogen must, by uniting with one portion of the oxygen of the nitric acid and taking hold of the base, expel all the nitrogen with the rest of the oxygen.

15. Having submitted the preceding facts and considerations, my explanation of the stupendous explosion which forms the topic of this communication is as follows:—

Of the enormous quantity of nitre which the store held, more than 56,000 pounds were on the first floor, about 180,000 pounds on the second floor, and about 100,000 on the third floor. The weight of combustible merchandise was about 700,000 pounds. As it was alleged by some of the witnesses examined that the iron window shutters of an upper story became red-hot by the conflagration of an adjoining house, it is probable that fire would be communicated to some of the gunny bags holding the nitre, or some other combustibles, which, as stated in evidence, were piled against the shutters. As soon, however, as a single bag became ignited, the nitre with which the inner bag must have been imbued, would give the greatest deflagrating intensity to the consequent combustion; while the interstices between the bags, like those between grains of gunpowder, would enable the flame to pervade the whole heap of bags. As nitre fuses at a low red heat, very soon a great quantity, in a state of liquefaction, must have run down upon the wooden floor, which would immediately burst into an intense state of reaction with the oxygen of the salt. To this combustion, the merchandise adjoining would add fuel, causing a still more extensive liquefaction of the nitre. The deflagrating mass thus created, on burning its way through the floor, or falling through the scuttles, which were all open agreeably to the evidence, must have received an enormous reinforcement from the subjacent nitre or combustible merchandise. On the giving way of each floor in succession, the conflagration must have received a reinforcement of deflagrating fuel, so as to have grown rapidly with its growth, and strengthened with its strength. Under these circumstances, the whole of the nitre, becoming liquefied, must have found its way to the cellar. Meanwhile the merchandise and the charcoal of the wood-work must have been conglomerated by the fusibility of the sugar, shell-lac and bitumen, aided by the molasses, and formed thus an antagonistic mass of more than half a million of pounds in weight, deflagrating intensely with the nitre. But whenever, by these means, a portion of the deflagrating congeries attained the fulminating temperature, a detonation must have ensued, causing a temporary lifting of the combustible mass: only, however, to be followed by a more active collision, resulting from the subsequent falling back of the conglomerated combustible mass upon the melted nitre. After every such collision, the combustible congeries must have been blown up to a height augmenting with the temperature, the force of the fall, and extent of reciprocal penetration. The force of the fall would, of course, be as the height. Hence the twelve or thirteen successive detonations indicate as many explosive collisions; while the successive augmentation of the loudness of the reports indicates a proportionable growth of their violence, arising from successively greater elevation and descent.

To be concluded in our next.

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chemists above mentioned (as having been called upon by the Corporation of New York to investigate the phænomena under consideration) treated the absence of this condition as a reason for discrediting the idea that the reaction of nitre with combustibles could account for them. But agreeably to the facts, I propose to show that there must have been a mechanical force in operation sufficient to bring the matter into a state analogous to that which enables fulminating combinations, or explosive mixtures of gas, to detonate either from ignition, from exposure to an electric spark, or, in some instances, from a blow or catalysis; in other words, from some influence like that exercised by platina sponge.

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OBSERVATIONS ON SULPHURET OF GOLD, AND DETERMINATION OF THE ATOMIC WEIGHT OF GOLD BY MEANS OF A NEW METHOD.*

BY M. A. LEVOL.

WITH the exception of M. Dumas, who, in his *Traité de Chimie*, mentions only one sulphuret of gold, of a brown color and of the formula Au^2S^3, all authors have repeated, according to Berzelius, that gold forms two sulphurets corresponding to the two oxides of gold Au^2O, and Au^2O^3 hitherto admitted. They prepare these two sulphurets by means of the sesquichloride of gold: the first, by precipitating a boiling solution of this salt by sulphuretted hydrogen; the second, by operating at the ordinary temperature: but it is singular that, agreeing as to their preparation, they in general differ as to the characters which they assign to them. According to some, for example, the sulphuret of gold obtained cold is black, and yellowish brown according to others, who, however, in speaking of the reactions of gold indicate among the number of the characters of the salts of gold, their precipitation black by sulphuretted hydrogen and the sulphurets, which evidently implies contradiction.

Being desirous of elucidating this point, I arrived at results so little in harmony with the facts detailed in books, that I consider it my duty to publish them, if only to induce chemists to unite in their efforts to rectify errors which are so much the more accredited as very distinguished chemists have often contributed to their propagation by copying them without investigation into their works.

PROTOSULPHURET OF GOLD.

With the view of preparing protosulphuret of gold, I precipitated the boiling solution of 1 gramme of pure gold, converted into chloride and diluted with about 200 grammes of distilled water, by sulphuretted hydrogen; I thus obtained a yellowish brown precipitate instead of the black one which should have been formed according to most writers. This is assuredly a very considerable difference, but it is not all. The precipitate very accurately represented the weight of the gold employed, and it acquired the metallic lustre of gold under the burnisher. The liquor, treated by chloride of barium, gave 0·445 gr. of sulphate of baryta=152 of sulphuric acid.

According to these results, the following is what occurs in the reaction:—

$$4Au^2Cl^3+3HS+9HO=8Au+12ClH+3SO^3.$$

The quantity of sulphuric acid obtained in the sulphate of baryta is, in effect, exactly that which this reaction requires.

It is evident, therefore, that in the conditions indicated by the authors for obtaining the protosulphuret of gold, the sesquichloride of that metal is completely reduced by sulphuretted hydrogen.

SESQUISULPHURET OF GOLD.

Having performed the same operation at the ordinary temperature to obtain the sesquisulphuret of gold, I collected a black, homogeneous precipitate, retaining water with great obstinacy, as Oberkampf had already said; I found it necessary to heat it to 284° F., to reduce it to the stable weight of 1·160 gr., representing, in 100 parts of sulphuret:—

Gold	86·2
Sulphur	13·8
	100·0

I cannot suspect any loss of sulphur, for this sulphuret, heated in a glass tube, appears to begin to be decomposed only above 392° F.

It is known that Oberkampf had found 19·61 per cent., by calcination, in a sulphuret which he said he had dried with care, but without stating at what temperature; then, after mentioning this result, he adds: "it is a *maximum*, for it might possibly contain a little water." I may add that before him Bucholz found only 18 per cent. in a similar sulphuret; moreover, Oberkampf says positively that the sulphuret which he analysed was black, and it is surprising that Berzelius, who indicates the results of Oberkampf's analysis, refers them to a yellow sulphuret.

The black sulphuret appears to be endowed with very great stability: thus, for example, so far from being spontaneously decomposed as has been erroneously stated, it undergoes no decomposition when boiled in the liquor in which it is formed, and in which, as stated above, it cannot be produced.

The composition which I have just assigned to this sulphuret has also been confirmed by the estimation of the sulphur in the sulphuret itself, and of the sulphuric acid in the liquor in which this sulphuret is formed, giving rise to a certain quantity of sulphuric acid.

0·646 gr. of sulphuret, first gently and afterwards strongly calcined, left 0.552 of pure gold. Whence the following composition per cent:—

Gold	85·4
Sulphur	14·6

* *Annales de Chimie, et de Physique*, Nov., 1850.

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0·450 gr. treated by nitric acid, which readily attacks it, gave 0·442 of sulphate of baryta with the chloride of barium=13·5 of sulphur in 100 of sulphuret.

Finally, the liquor separated from the sulphuret after its complete precipitation, gave by chloride of barium 0·150 gr. of sulphate of baryta.

These different data lead to the following equation, expressing the reaction, without heat. of sulphuretted hydrogen on sesquichloride of gold:—

$$4Au^2Cl^3+9HS+3HO=4Au^2S^3+12ClH+SO^3.$$

From the foregoing, it results that the black sulphuret is neither the sesquisulphuret Au^2S^3, whose formula is rendered into per cents. by

Gold	80·3
Sulphur	19·7,

and which, as we have seen, has been admitted, analogically, only according to the analysis formerly made by Oberkampf, and concerning which that chemist himself entertained some doubt; nor the protosulphuret Au^2S, which would contain in 100 parts—

Gold	92·4
Sulphur	7·6

but of which I do not know that any analysis has ever been made, or even that it has been obtained or exists.

The composition of the black sulphuret would then be intermediate to those of the protosulphuret and of the sesquisulphuret: it may, therefore, be represented by Au^2S^2, or else by $Au^2S+Au^2S^3$, which require in 100 parts:—

Gold	85·95
Sulphur	14·05

I will not undertake to discuss the question as to which of these two formulæ should be adopted; I will only remark that by admitting Au^2S^2, the black sulphuret would correspond to the purple oxide of gold, which has not yet been obtained, it is true, but whose existence appeared very probable to Berzelius as well as to several other chemists.

I think it needless to add that I by no means pretend to deny the existence of the sulphurets of gold Au^2S and Au^2S^3; I only think that I have proved that they are not produced in the conditions in which they have hitherto been supposed to be obtained.

I will conclude by giving a determination of the atomic weight of gold by a new method:—

It is known that the atomic weight of gold was determined by Berzelius, first by fixing the quantity of mercury for effecting the decomposition of the chloride of gold: in this way, he found 1243·01; but the accuracy of this expression was dependent on that of the atomic weight of mercury, and this having of late years undergone considerable diminution, it became necessary to correct the old atomic weight of gold, on account of the correction made in that of mercury, and the weight of the atom of gold was reduced to 1227·45.

On the other hand, when Berzelius became acquainted with the change which had been made in the atomic weight of mercury, he hastened to determine that of gold by a different method from that which he had first employed: this time it was by the analysis of the potassio-chloride of gold; he found 1229·41.

Although the accordance between this new weight and the former rectified one may be satisfactory, finding myself in possession of some chemically pure gold, I thought that it might be of some interest to adopt a new method, inasmuch as one presented itself to my mind, which appeared to me to unite to the greatest simplicity very few chances of error: this method consists in converting into chloride, in a small matrass, a certain quantity of pure gold, weighed in an assay balance, in decomposing this salt by a stream of washed sulphurous acid, then weighing, in the state of sulphate of baryta, the sulphuric acid formed according to the known reaction

$$Au^2Cl^3+3SO^2+3HO=2Au+3SO^3+3ClH.$$

The only particular precaution which must be observed here, is to avoid all conversion of sulphurous acid into sulphuric acid at the expense of the surrounding oxygen; and nothing is more easy, provided that the operation be performed on the solution of gold in full ebullition, and that it be continued some time after the reduction of the chloride of gold, in order to completely drive off all excess of sulphurous gas.

1 gramme of pure gold, converted into chloride of gold, thus produced 1·782 gr. of sulphate of baryta.*

$$1782 : 1000 :: 3BaO, SO3=4373·07 : x=2454·02.$$

* It will be understood that in this operation, as in the foregoing, it is important to avoid the presence of nitric acid: with that view, after having dissolved the gold in a sufficient quantity of aqua regia, containing a large quantity of hydrochloric acid, and having reduced the liquor to the smallest possible bulk by evaporation, I redissolved it in pure hydrochloric acid, and evaporated it again as the first time, before diluting it with water for use.

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Therefore Au=1227·01, a number which approximates to the atomic weight of gold calculated from the new atomic weight of mercury.

A second determination furnished precisely the same result. This time, I substituted for water in the first of the two washing flasks which I used in the first experiment, a solution of chloride of barium.

ON THE DETECTION OF LITHIA IN THE PRESENCE OF SODA BY THE BLOWPIPE.*

BY E. J. CHAPMAN, PROFESSOR OF MINERALOGY IN UNIVERSITY COLLEGE, LONDON.

THE red color imparted by lithia compounds to the blowpipe flame is well known to be entirely destroyed by the presence of soda. Stein has stated † that the characteristic crimson color may be rendered visible, even when a large proportion of soda is present, by fusing the mixture on a platinum wire, saturating it with tallow, and again igniting it by the unaided flame of a candle, excess of temperature being, in his opinion, the principal cause by which the soda flame prevails to the obliteration of that produced by lithia. This method is however by no means infallible; the reaction, if obtained at all, can last but for an instant; and as the tallow in its combustion frequently produces a reddish-yellow flame, and always an intense blue one sufficient in itself to prevent the momentary reaction from being properly seen, conviction of either the presence or absence of lithia will rarely be established in the operator's mind. Some other less uncertain method is therefore desirable; and the following will, I think, be found to answer the purpose:—

The assay, which we will here suppose to consist of the two substances in question, is to be fused in a good blast with chloride of barium on a loop of platinum wire. Decomposition readily takes place; alkaline chlorides are formed and volatilised; but, contrary to what is generally stated in chemical works respecting the volatilisation of these compounds, the chloride of sodium is driven off before the chloride of lithium, so that the powerful yellow flame at first produced gradually diminishes; and by-and-by a thin green light, occasioned by baryta, is seen to stream from the point of the wire as the assay shrinks down into the coil of the loop. If this latter be then advanced within the edge of the blue flame, the red coloration will quickly ensue, and endure sufficiently long to prevent the slightest chance of misconception or uncertainty.

To satisfy myself thoroughly in this respect, I prepared a mixture of 2 parts of ignited carbonate of soda with 1 part of carbonate of lithia, and placed portions of this in six little porcelain capsules, distinguished upon their under sides by a spot of ink. Then into six similar capsules, but without the ink spots, I placed portions of carbonate of soda only, and arranged the twelve indiscriminately upon a tray, in such a manner that I could not recognise one from another. On testing each of these by the above method, I found to my satisfaction that I could correctly separate, and without hesitation, the six containing lithia from the others. The only point to be attended to in order to ensure success, or rather to avoid the least chance of failure, is to have a clear, sharp, and not too large a flame, especially when the little reaction begins to manifest itself.

* *Chemical Gazette*, Nov. 15, 1850.

† *Journal für Prakt. Chém.*, xxxi. 362.

ON SAPONINE.*

BY M. FERDINAND LE BEUF.

ALTHOUGH the saponine from the Egyptian saponaria (*Gysophila struthium*) was studied by Professor Bussy in 1832, and from the *Quillaja saponaria* by MM. Henry, Jun., and Boutron-Charlard in 1828, it has not hitherto been used in a state of purity in medicine or otherwise, whereas the vegetables containing it have been, from time immemorial, employed for various purposes in the countries to which they are indigenous.

M. Le Beuf especially mentions the barks of two of these vegetables, the *Yalhoy* and *Quillay*. The first of these barks, which belongs to the *Monina polystachia* of Ruiz and Pavon, of the family of Polygalæ, appears to be produced in the neighborhood of Huanuco in Peru. It was studied by the celebrated botanist, Ruiz, who made it the subject of a memoir published in 1805. If he is to be believed, this substance may be regarded as a specific against dysentery and obstinate diarrhœa, a property which is confirmed by the experiments of several distinguished medical men in Madrid. This bark is besides used in Peru for various economical purposes in which it replaces soap. Chemical analysis has found a considerable quantity of saponine in it. The high price of *Yalhoy* prevents it from

* *Comptes Rendus*, 4th November, 1850.

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being used in the preparation of saponine; it must be confined to medical purposes.

The bark of the *Quillaja saponaria* has, in this respect, great advantages. It contains a larger quantity of saponine than the preceding, and it is not nearly so dear in price. Therefore it is the *Quillay* of which we must avail ourselves in the preparation of saponine.

The following process is described by M. Le Beuf as used by him in the extraction of this saponacious principle.

We used a displacement apparatus of tinned copper, of the capacity of from 10 to 12 quarts, to which we had soldered a double body which enclosed it to its whole height; to this we added a circular trench or gutter placed immediately over the lower tap, intended to contain the spirit of wine to heat it. Having put 2500 grammes of ground Quillay into the receiver which acted the part of a water-bath, the apparatus was suspended to an iron stand; about 8 quarts of alcohol at 96° were poured on to the Quillay; the double body surrounding the water bath was filled with boiling water; the trench was filled with spirit which was lighted. When this was consumed, more was added, and the heating was continued until the alcohol in the water bath arrived at the boiling point. The spirit of wine in the trench was allowed to burn out, and when the flame was extinguished, the tap was opened, and the alcohol containing the saponine was received into an earthen pan.

This alcoholate of saponine was of a deep orange color; when removed from the apparatus it was perfectly clear, but on cooling it became turbid, and yellowish flocks were precipitated to the bottom of the vessel. When cold, this liquor was poured into a bottle of the capacity of about 6 quarts, having a stoppered tubulure about 7 or 8 centimetres from the bottom; after 24 hours, the precipitated saponine occupied the lower portion of the vessel: the tubulure was uncorked without shaking the bottle, and the colored alcohol poured into an earthen pan, and the precipitate of saponine found below the tubulure was put aside. This method of decantation appeared to us necessary for the complete separation of the precipitate from the liquid portion, as the saponine would rise and remingle with the liquor, if the vessel at the bottom of which it is precipitated be the least shaken.

To obtain the saponine perfectly pure, the precipitate must be washed with sulphuric ether which will remove the coloring matter, and the ether must be renewed until it is left almost colorless. We think, however, that the saponine obtained by cooling the alcohol will do for medicinal purposes without further preparation.

The 6 quarts of alcoholate of saponine, separated from the precipitate, gave, on the evaporation of the alcohol, 162 grammes of saponine of much deeper color than that precipitated by simple cooling. But the bark was not exhausted of the saponine contained in it, and a new addition of alcohol at 90° produced an extract equal to one-third of that obtained by the first treatment. The alcoholate of saponine retained in solution, after cooling, about 27 grs. of saponine to the quart, or 3·375 per cent.

Saponine is soluble in water like the pure gums, and soluble in alcohol like the resins. This remarkable property which had been before mentioned, but made no use of, has been made available by M. Le Beuf in rendering soluble in water bodies which had, hitherto, been soluble only in alcohol. He has made the discovery, which he thinks quite new, that all bodies soluble in alcohol at 90°, become divisible into imperceptible molecules and soluble in appreciable quantities in water, by the intervention of alcoholate of saponine.

He has been enabled, by this means, to put in suspension in water balsam of Peru, balsam of tolu, resin of guaiacum, balsam of copaiba, castor oil, Norway pitch, assafœtida, euphorbium, croton oil, gamboge, resin of jalap, lactucarium, camphor, the volatile oils, &c.; and to obtain emulsions like milk, which will remain unaltered: he has some samples which, after six months, remain unchanged.

The author thinks that the same method might be employed to suspend in water the various preparations of iodine, quininæ, bichloride of mercury and the salts of morphia, in cases in which these medicines have to be administered internally.

Another singular fact is the division of metallic mercury in alcoholate of saponine. When a certain quantity of this metal is poured into this alcoholate and the bottle shaken, the mercury divides into very minute particles which have the appearance of iron filings. These molecules have remained separate for six months. On decanting the liquor, and pouring the divided mercury into lard, they mix with the greatest promptitude, and trituration for two hours is sufficient to render the metal invisible through a magnifying glass.

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ON THE ARTIFICIAL FORMATION OF LACTIC ACID AND ON A NEW BODY HOMOLOGOUS WITH GLYCOCOLLE.*

BY M. AD. STRECKER.

We have already communicated the principal results of the important work lately published by M. Strecker. To complete what is at present imperfect, we give here some details of M. Strecker's researches which cannot fail to interest our readers.

It has been observed that aldehyde, or the combinations derived from it, constitutes a very frequent product of the decomposition of lactic acid. This fact has led M. Strecker to the supposition that lactic acid was very probably a conjugate combination of formic acid and aldehyde, in a similar manner to formo-benzoïlic acid; in which the elements of formic acid are found in intimate combination with those of benzoïc aldehyde or the essence of bitter almonds. The two following formulæ show the analogies of their composition:—

$$\underbrace{C^2H^2O^4}_{\text{Formic acid.}} + \underbrace{C^4H^4O^2}_{\text{Aldehyde.}} = \underbrace{C^6H^6O^6}_{\text{Lactic acid.}}.$$

$$\underbrace{C^2H^2O^4}_{\text{Formic acid.}} + \underbrace{C^{14}H^6O^2}_{\text{Ess. Bitter almonds.}} = \underbrace{C^{16}H^8O^6}_{\text{Formo-benzoïlic acid.}}.$$

As formo-benzoïlic acid is formed by the union of the essence of bitter almonds with formic acid in the primitive state, so we might hope to obtain lactic acid artificially, by means of a similar reaction, replacing the essence of bitter almonds by ordinary aldehyde: in fact, M. Strecker has prepared artificial lactic acid by means of this process. He did not obtain it direct, but by a circuitous plan which has led him to the discovery of another very interesting body.

THE ACTION OF PRUSSIC ACID ON ALDEHYDE-AMMONIA.

If a mixture of aldehyde-ammonia and aqueous prussic acid be left in stoppered bottles, the acid is quickly decomposed and deposits a brown powder. If, on the contrary, the aqueous solution of aldehyde-ammonia and prussic acid be evaporated rapidly in the sand-bath, there remains a brown syrup, which at the end of some hours becomes a mass of fine needles. This body which is formed after the purification of the brilliant and colorless needles, dissolves in water, alcohol, and ether. The aqueous solution forms no precipitate with the salts of silver.

It possesses basic properties, at least it is transformed, when treated by the acids, into a base which forms, with chloride of platinum, a double combination soluble in water. M. Strecker has not yet finished the study of this body.

ALANINE.

When the aqueous solution of aldehyde-ammonia is mixed with prussic acid in the proportion of 2 parts of aldehyde-ammonia to 1 part of anhydrous prussic acid, and when aqueous hydrochloric acid is added in excess, this acid disengages no trace of aldehyde. By distillation of the mixture are obtained only hydrochloric acid and a small quantity of prussic acid, and sometimes a little formic acid.

The residue of this distillation, evaporated in the sand-bath, furnishes an abundant cyrstallisation of hydrochlorate of ammonia and an acid mother liquor which contains the hydrochloric combination of a new body which M. Strecker calls *alanine*.

To separate the hydrochlorate of alanine from the great excess of the hydrochlorate of ammonia with which it is mixed, the residue, when evaporated and dried in the sand-bath, is treated with a small quantity of cold water. The undissolved hydrochlorate of ammonia is separated by filtration, and the filtered liquid boiled with hydrated oxide of lead. It is again filtered to separate the basic chloride of lead, and a current of sulphuretted hydrogen is passed through the solution, which contains a great excess of lead. The solution, freed from the sulphate of lead, furnishes, by evaporation and cooling, crystals of alanine.

This body crystallises from the saturated aqueous solution in colorless needles grouped in tufts. Sometimes these are of sufficiently large dimensions to render their form, oblique prisms with rhombic base, evident. They are soft, crush between the teeth, and have a pearly lustre. At 62° F. they dissolve in 4·6 parts of water. They are more soluble in warm water; sparingly soluble in cold alcohol, 1 part of alanine requiring 500 parts of alcohol at 80 per cent. to dissolve it. Alanine is completely insoluble in ether. The aqueous solution has a very sweet taste; it has no effect on litmus paper, and gives no precipitate with any of the ordinary reagents.

When alanine is heated above 392° F., it sublimes and condenses in fine lanuginous crystals near the point heated. It melts and partially decomposes when heated very rapidly.

The composition of alanine is expressed by the formula

$$C^6H^7NO^4.$$

* *Annalen der Chemie und Pharmacie*, t. lxxv, p. 27.

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According to which it is easy to explain its mode of formation by means of the following equation :—

$$\underbrace{C^4H^4O^2}_{\text{Aldehyde.}} + \underbrace{C^2NH}_{\text{Prussic acid.}} + 2HO = \underbrace{C^6H^7NO^4}_{\text{Alanine.}}.$$

The ammonia of the aldehyde-ammonia is combined with hydrochloric acid.

The formula of alanine is identical with the formulæ of the three other bodies, *urethane, lactamide* and *sarcosine.* Urethane and lactamide are distinguished from alanine not only by their point of fusion, which is below 212° F., but by many other physical and chemical properties. Sarcosine, on the contrary, resembles alanine in many properties, such as its flavor, its solubility, its behavior when heated, and its property of combining with acids. Still, these two substances are clearly distinguishable when carefully examined. Sarcosine dissolves more readily in water, and sublimes before 212° F.

Alanine constitutes the real homologue of glycocolle, and not sarcosine, as will be seen by the details we are now about to communicate.

COMBINATIONS OF ALANINE WITH THE ACIDS.

Alanine dissolves in acids more readily than in water and without causing them to lose their acid reaction; the addition of alcohol causes no precipitation from these solutions.

NITRATE OF ALANINE.

This is obtained in the form of long colorless needles, deliquescent in humid air, very soluble in water, a little less soluble in alcohol. At 212° F., they do not lose in weight, but they by degrees begin to change, and become yellow. Their composition is represented by the formula

$$C^6H^7NO^4, NO^6H.$$

HYDROCHLORATE OF ALANINE.

Alanine combines with hydrochloric acid in at least two proportions. When hydrochloric acid gas is passed over dry alanine, this gas is absorbed, and a combination is obtained, soluble in water, but little soluble in alcohol, and containing 2 equivalents of alanine, and 1 equivalent of hydrochloric acid. The salt obtained by evaporating a solution of alanine in an excess of hydrochloric acid is very deliquescent and very soluble in alchol. It contains

$$C^6H^7NO^4+ClH.$$

Neither the aqueous solution, nor the alcoholic solution of the hydrochlorate of alanine is precipitated by chloride of platinum. But if a mixture of the two salts be evaporated to dryness and the dried mass taken up by alcohol to which has been added a little ether, this solution, when left to spontaneous evaporation, deposits fine yellow needles, soluble in water, alcohol, and even in etherised alcohol. The composition of this combination is expressed by the formula

$$2(C^6H^7NO^4)+ClH+2PtCl^2.$$

The properties of this double chloride render it easy to distinguish alanine from sarcosine. The hydrochlorate of sarcosine and platinum is insoluble in etherised alcohol, and forms large octohedral crystals.

The sulphate of alanine is uncrystallisable.

COMBINATIONS OF ALANINE WITH THE METALLIC OXIDES.

An aqueous solution of alanine is colored blue when boiled with oxide of copper. The solution, when evaporated, deposits dark blue crystals, which under the microscope appear to be in the form of tables with six rather elongated faces, or in that of rhombordal prisms. This combination of alanine and oxide of copper dissolves readily in water and is almost insoluble in alcohol. The aqueous solution is of an intense blue color, and becomes almost colorless when nitric acid is added to it. These crystals do not change at 212° F. They are formed of

$$C^6H^6NO^3,CuO.$$

Alanine likewise dissolves oxide of silver with heat, forming a colorless solution which, when cool, deposits small yellowish needles. These crystals, which are very soluble in water, color by degrees in the light, and when exposed whilst still moist, to the temperature of the sand-bath, they contain

$$C^6H^6NO^3,AgO.$$

Oxide of lead dissolves abundantly in a boiling aqueous solution of alanine, and by the evaporation of the liquor is deposited in colorless crystals of a compound containing

$$2(C^6H^6NO^3, PbO)+PbO, HO.$$

Even baryta will combine with alanine and form with it a crystallisable compound. It is obtained by boiling an aqueous solution of alanine with carbonate of baryta.

It will be evident from the whole of its properties that alanine is very similar to glycocolle and leucine, and that it, and not sarcosine, as at first supposed, forms the true homologue of these bodies. These substances form a series which still has some vacancies, but they are inconsiderable.

Glycocolle.	$C^4H^5NO^4$
Alanine	$C^6H^7NO^4$
Unknown term	$C^8H^9NO^4$
Unknown term	$C^{10}H^{11}NO^4$
Leucine	$C^{12}H^{13}NO^4$

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METAMORPHOSES OF ALANINE.

When a solution of potassa to which alanine has been added, is evaporated until a great part of the water has been driven off, a disengagement of ammonia and hydrogen will be observed. The residue, decomposed and distilled with an excess of dilute sulphuric acid, furnishes prussic acid and a volatile acid which appears to be acetic acid. Leucine, in the same circumstances, gives rise, as is known, to valerianic acid homologous to acetic acid, and glycocolle gives cyanide of potassium and oxalic acid, a product of the decomposition of formic acid.

Peroxide of lead heated with an aqueous solution of alanine decomposes this substance, disengaging carbonic acid, aldehyde and ammonia.

The conversion of alanine into lactic acid is operated by means of a reagent which has only lately been used, and the employment of which promises, in certain cases, very interesting results. This is nitrous acid, which M. Piria first used for the transformation of asparagine into malic acid. M. Strecker showed, some time since, that this acid, either alone or combined with oxide of silver or of mercury, will cause in certain nitrogenous substances which are unalterable by the acids and alkalis, transformations identical to those of the amides. He expresses the mode of action of this reagent by the following general formula :—

$$NO^2+CnHmNOp=CnHm-1Op+2+2N+HO,$$

which amounts to saying that NH is eliminated from the nitrogenous combination and is replaced by O^2.

M. Strecker then directed a current of nitrous gas through a solution of alanine. Nitrogen was disengaged, and by the evaporation of the liquid a powerfully acid residue was obtained, which yielded to ether a liquid possessing all the properties and composition of lactic acid. The remarkable reaction which gave rise to this acid may be rendered by the following formula :

$$C^6H^7NO^4+NO^3=C^6H^6O^6+2N+HO.$$

The author considers that this mode of forming lactic acid is confirmatory of the hypothesis which regards lactic acid as a conjugate combination of formic acid and aldehyde.

ANALYSIS OF TWO ANTIQUE BRONZES OF THE GALLO-ROMAN EPOCH.*

BY M. SALVETAT.

ALTHOUGH a great number of analyses of ancient alloys have already been published, it has appeared to me useful to make known the composition to which I have been led by the examination of two antique bronzes found in a tomb of the celebrated city of Lime. Such investigations, which are of indisputable value for affording useful information, assume a still greater importance, when, possessing a characteristic of more general interest, they may aid in reconstituting the ancient chemical art.

It is much to be regretted that all the analyses which have hitherto been made have not been accompanied by sufficiently precise details concerning the circumstances which have led to the discovery of the alloys analysed, and to the age to which the people who used them may be referred; these details would certainly throw great light on the metallurgy of the ancients. Although it is true that the determination of the principles made use of by ancient art is perfectly executed, as it refers generally to materials of ancient origin, still, being without certain date, it can scarcely augment the number of positive data which we possess on the processes practised in the different ages of antiquity.

It will doubtless take a long time to elucidate the question; therefore, we should not allow to escape any of those rare occasions which antiquaries or amateurs, truly friends of science may generously offer, by sacrificing some of the materials which chance, or long, costly and indefatigable investigations may have placed in their hands. I therefore thankfully availed myself of the opportunity afforded me by M. Feret, the learned librarian of the City of Dieppe, of examining the composition of two bronze rings which he had found under very clear circumstances.

I will append to these analyses an extract from the letter in which M. Feret indicates the locality from which these rings were procured, and the people to which he supposes them to have belonged.

One of the rings was blackish externally, fragile, with a greyish fracture; its external diameter was 13·535 millimetres; it was in a complete state of preservation. I found it to be composed of :—

Tin	23·52
Copper	75·55
Lead	0·47
Loss	0·46
	100·00

with traces of silver, nickel and antimony, without zinc.

The other, which was less brittle, had a slightly yellowish fracture, and a less deep external color; its external diameter was

* *Journal de Pharmacie*, Nov., 1850.

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22·558 millimetres; it presented here and there some spots of decay, converted into carbonate of copper, and of a green color. I found it to be composed of:—

Tin	15·73
Copper	79·93
Lead	3·50
Loss	0·84
	100·00

with traces of silver, but neither nickel nor zinc.

Both of these rings were found in the same tomb. The following is the portion of M. Feret's letter in which he discusses the origin of these two bronzes:—

"I found these rings, in 1826, among others of the same nature, in a Gallo-Roman tomb, which, according to all appearances, seemed to be of the date of the second half of the fourth century. Among the medals found in this monument, the last was of the date of Flavius Valens: now this emperor died in 378: the pottery found near the skeleton which this tomb contained also belongs, from its characters, to the same period.

"It is as well, nevertheless, to remark that this tomb, which was situated on a hill by the sea side, was in the *city of* Lime, a vast enclosure, surrounded by trenches, which is about a league distant from Dieppe, and that this enclosure contains in its soil remains of very different ancient dates. The purely Gallic period is frequently shown, and, in the inferior layers of the tomb, Celtic pottery, axes, and medals were found.

"I think, however, that the rings which you have analysed belong to the fourth century, more especially as they resemble other objects of the same nature, which I may class amongst the Gallo-Roman antiquities towards the latter end of the Lower Empire.

"I think that there is much to be done concerning these ancient bronzes, which have now stood the test of time. Works of this kind will render more clear that which Pliny says of alloys. It appears, according to him, that the brass fused by the Gauls presented remarkable qualities. It was heated to the incandescence of the stones between which they run it. The heat was so violent that it burned the metal, which became black and brittle: *coctura nigrum atque fragile conficitur.*—Pl. lxxiv, 20."

The absence of zinc, in the foregoing compositions, is by no means surprising. M. Göbel announced, a long time ago, according to his researches, and those of Vauquelin and Klaproth, that the bronzes of ancient Greece or of its colonies, found either in Greece, Italy, Egypt or Asia, are essentially composed of lead, copper and tin, or simply of copper and tin. Analyses of ancient metals collected in Greece, performed in Erdmann's laboratory, also confirm this opinion.

The analyses made by Fresenius and Knapp of Celtic arms, and those by M. Moëssard, executed on antique bronzes found in the department of the Oise, and attributed to the Roman period, and the foregoing, tend to generalise the fact announced by M. Göbel, and to extend it to the Celtic, Gallo-Roman and Roman periods.

The presence of nickel in one of the rings found in the tomb of the city of Lime, is not an isolated fact. Fresenius detected 0·0031 in a Celtic battle axe found near Giessen, and M. Knapp found 0·0283 in the bronze of a Celtic battle axe found buried in the turf near Ceriguey-Druydon, in Wales.

I suppose that the preservation of the alloys of the City of Lime can be attributed only to the small proportion of tin they contain.

NOTE ON THE PRESENCE OF CASEIN AND THE VARIATIONS OF ITS PROPORTIONS IN THE BLOOD OF MAN AND ANIMALS.*

BY MM. NATALIS-GUILLOT AND FELIX LEBLANC.

SINCE the period at which one of us had the honor of communicating to the Academy the results which demonstrated to us the presence of caseïn in the blood of nursing women, we have greatly extended our researches. We have examined no fewer than seventy samples of blood of various origin, and we consider that we are now able to add fresh conclusions, which we regard as of some interest in a physiological, pathological and zoonomical point of view.

Several facts result from the study to which we have devoted ourselves, which we may recapitulate as follows.

The presence of caseïn in solution in the blood of man, woman and various animals, is a normal fact. We may mention among animals, the blood of the bull, the cow, the ox, the he-goat, the she-goat, the ram, the wether, the ewe, the pig, the dog, and the fœtus of the sheep and cow.

The proportions of caseïn vary according to the animals, the sex, and several circumstances of alimentation, health and disease.

* *Comptes Rendus*, No. 17, Oct. 21, 1850.

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These variations have an amplitude which greatly exceeds those of the constituent elements of the blood estimated in the analyses of that fluid.

It is at the period of gestation, a short time before parturition, and during lactation, that the proportion of caseïn is found at its maximum in woman and female animals.

During intra-uterine life, the nutrition of the fœtus appears to be supplied, at least partially, by the caseïn which is found in abundance in the placenta, and which we also extracted from the cord. This interesting fact had also been noticed by M. Stas, after having discovered the presence of caseïn in the allantoïd.

In certain pathological cases, the proportion of caseïn diminishes greatly, even in the blood of pregnant women or nurses. Caseïn may even cease to be appreciable to reagents.

These facts were proved in pregnant women, or women recently confined and attacked with erysipelas, anasarca, pleuropneumonia, pleurisy, peritonitis, puerperal fever, &c.

It will be interesting to place side by side these facts and the absence of the lacteal secretion.

These are analogous morbid circumstances which explain the absence of caseïn from the blood of still-born infants, (which absence we noticed in our former note) whilst the blood of living new-born children or animals contains a large quantity.

Does the caseïn which can no longer be detected by reagents coagulate and unite to the blood globules, or is it eliminated by the emunctories of the economy, or rather does it only undergo an isomeric transformation, passing to the state of a new albuminoïd matter? We are now investigating this, but it is a point on which we do not consider ourselves at present able to speak with certainty.

The blood of castrated animals (ox, sheep) having presented a very large quantity of caseïn, we asked ourselves whether the same would be the case with perfect animals. Experiments made with the blood of the bull and the ram indicated caseïn in considerable proportion; however, we observed in the blood of the bull marked differences in individuals.

The blood of a boar yielded us no caseïn at all, whilst the blood of a sow, not with young, furnished small quantities of it.

We then asked ourselves whether the state of fasting or fulness could exert any influence on the proportion of caseïn contained, at a given moment, in the blood of the same animal.

We undertook on this subject investigations which appear to us already to give results interesting from their variations; but the experiments are not yet sufficiently numerous to decide the question absolutely.

We may say as much relative to the examination of the influence of the nature of the food on the presence and proportions of caseïn in the blood.

Does caseïn constitute an aliment better adapted for assimilation than other albuminoïd matters. One would be tempted to believe this in comparing the last facts which we have just quoted with the phenomena of nutrition in the fœtus at the expence of sanguineous fluid rich in caseïn.

It is in the blood of healthy females during lactation that caseïn is found in the highest proportion, and the blood, collected in these conditions, readily admits of the extraction of caseïn. The processes of extraction and purification are at least as simple as if they were applied to milk.

The presence of caseïn in greater quantity in the blood of milk cows should lead us to seek for sugar in the same blood.

Hitherto we have not experimented on large quantities of blood. But in operating on not more than a quart of blood, Frommherz's test indicated small quantities of sugar by the formation of a yellow and unmistakable precipitate, of hydrated protoxide of copper.

It is to be noticed that the matters soluble in alcohol arising from the dry extract in which sugar might be found, gave no precipitate with the cupreous liquor, whilst the reduction was operated under the influence of the aqueous solution of the residue treated by alcohol. This experiment, therefore, renders the existence of sugar of milk, instead of grape sugar, very probable. Experiments on larger quantities of the blood of milk cows alone can enable us to arrive at a more certain conclusion.

ON THE FORMATION OF NITRO-HIPPURIC ACID IN THE ANIMAL ECONOMY.*

BY SIGNOR CESAR BERTAGNINI.

THE author has proved a new fact in examining the modifications which several organic matters undergo in traversing the animal economy. Setting out from the known fact of the transformation of benzoïc

* *Journal de Pharmacie*, November, 1850.

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acid into hippuric acid, he ascertained that nitrobenzoïc acid introduced into the economy, gave rise to an acid which passes into the urine. The acid may be extracted, and presents the following composition :—

$$C^{18}H^{6}N^{2}O^{10}.$$

It must be regarded as nitro-hippuric acid. Indeed, Signor Bertagnini has derived from hippuric acid nitro-hippuric acid identical in its characters with that which was extracted from the urine in the circumstances above mentioned. It is sufficient, for that purpose, to heat hippuric acid by a mixture of fuming nitric acid and sulphuric acid.

Nitro-hippuric acid, whether artificial or extracted from the urine, is decomposed into nitro-benzoïc acid and sugar of gelatine when treated by hydrochloric acid.

It is curious to see benzoïc acid as well as nitro-benzoïc acid avail itself of the elements of sugar of gelatine in passing through the animal economy to constitute either hippuric or nitro-hippuric acid.

ANALYSIS OF THE ASHES OF THE SPANISH POTATO (CONVULVULUS BATATAS), AND OF THE EDDOES (ARUM ESCULENTUM, LINN., COLOCASIA ESCULENTA, SCHOTT).*

BY THORNTON J. HERAPATH, F.C.S.

THE Spanish or sweet potato and eddoes, although of little or no importance to the English agriculturist, are commonly cultivated for their roots in most, if not in all tropical climates, both in the eastern and western hemispheres. The tubers of these plants, in fact, are employed in large quantities in all the West Indian Islands as food for man and animals, and are looked upon in those countries, as is the potato in our own, being at the same time nutritious, and pleasant to the taste. Only the roots of the former, the batata, however, I am informed, can be made use of by Europeans, those of the latter, particularly when fresh, being extremely acrid, although not so much so as to render them unpalatable to the negroes, with whom they are a common article of food. This acrimony would appear to be caused by the presence of some volatile body, as the vegetable is said to become sweet and well-tasted after boiling, or when roasted in hot ashes.

Proximate analyses of these plants have been already performed by other chemists,* but no attempt, so far as I am aware, has ever been made to determine the nature of their inorganic constituents. It was, therefore, with the wish of supplying this desideratum that I undertook the present examination, as I thought my results might possibly be of service to some of those of my fellow-countrymen, who are connected with the interests of our West Indian colonies. For the specimens which I have operated upon, I am indebted to the kindness of my friends, Charles Thornton Coathupe, Esq., of Wraxall, and W. H. Richards, Esq., of Barbadoes, to both of whom I must acknowledge my obligations.

The *modus operandi* employed in the preparation and analysis of these ashes has been already fully explained in some of my former papers, which have been communicated to the Society.

I.—SPANISH POTATO OR BATATA.

749·54 grs. of the fresh roots, cut into thin slices, gave 249·34 grs. of dried vegetable matter, and furnished upon incineration 11·996 grs. of ash. Subsequent analysis, however, proved that this ash contained 0·690 grs. of charcoal and sand; consequently, the true inorganic constituents amounted to 11·306 grs. in weight=1·50849 per cent., numbers which correspond to :

Water and other volatile matters	66·7340
Vegetable matter	31·7575
Inorganic constituents	1·5085
	100·0000

The proportion per cent. of ash from the dried plant, therefore, amounted to 4·5347.

The 11·996 grs. of ash obtained as above, were found upon analysis, to be composed of :

Substances soluble in water (A)		7·883
,, insoluble ,, (B)		4·113

The solution A, when treated with reagents, gave :

Carbonic acid		0.9800
Sulphate of baryta	2·3700=So^3	0·8030
Phosphate of baryta ($3BaO\,PO^5$)	0·4508=PO^5	0·1058
Chloride of silver	5·7600=Cl	1·4400
Mixed chlorides of potassium and sodium	8·0770	
Potassio-chloride of platinum	22·066=KCl	6·7897=KO 4·2786
Chloride of sodium (by loss)		1·2873=NaO 0·6868

* *Quarterly Journal of the Chemical Society*, October, 1850.

* O. Henry, J. Pharm. [3] xi., 233.

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Quantities which are equivalent to:

		p. c. of ash.
Carbonate of potassa	3·118	27·5763
Sulphate of potassa	1·766	15·6243
Phosphate of potassa (3KO PO^5)	0·302	2·6771
Chloride of potassium	1·407	12·4465
Chloride of sodium	1·287	11·3904
	7·880	69·7146

The substances insoluble in water (B) furnished:

Carbonic acid		0·7040
Sulphate of baryta	traces	SO^3 traces
Earthy phosphates, &c.	1·626	
Perphosphate of iron	03·46 =	Po^5 0·1988, Fe^2O^3 0·1472
Phosphate of alumina	traces	
Pyrophosphate of magnesia	1·335 =	PO^5 0·8009
Carbonate of lime	2·449 =	Cao 1·3719
Pyrophosphate of magnesia	0·404 =	MgO 0·1613
Silica		0·2400
Charcoal, sand, &c.		0·6870

They were consequently composed of:

	p. c.	of ash.
Carbonate of lime	1·334	11·7070
Carbonate of magnesia	0·224	1·9828
Sulphate of lime	traces	traces
Perposphate of iron	0·346	3·0595
Phosphate of alumina	traces	traces
Phosphate of lime (3 CaO. PO_5)	1·160	10·2590
Phosphate of magnesia	0·120	1·0613
Silica	0·240	2·1258
Charcoal, sand, and loss	0·689	deducted
	4·113	30·2854

The per-centage composition of the ash of this plant, after deduction of the charcoal, sand, and carbonic acid, may be expressed as follows:

SOLUBLE SALTS:

		After deducting the CO^2.
CO^2	8·6671	
SO^3	7·1018	8·3448
PO^5	0·9357	1·0324
KO	29·3490	34·4848
NaO	—	—
KCl	12·4465	14·5070
NaCl	11·3904	13·3848

INSOLUBLE SALTS:

CO^2	6·2289	—
SO^3	traces	traces
PO^5	7·0720	8·3769
CaO	11·9545	14·2543
MgO	1·4265	1·6761
Fe^2O^3	1·3018	1·5207
Al^2O^3	traces	traces
SiO^3	2·1258	2·4092
	100·0000	100·0000

II.—EDDOES OR EDDOE.

749·18 grs. of the fresh root, when dried and incinerated, furnished 12·729 grs. of ash, which was afterwards found to contain 0·39 grs. of carbon and sand; consequently, the true weight of ash was equal to 12·339 grs.=1·6470 per cent.

These 12·729 grs. of ash, when treated with hot water, were resolved into:

Substances soluble in water (A) . . . . . 7·854
,, insoluble ,, (B) . . . . . 4·875

The aqueous solution (A), when treated in the usual manner, afforded of:

Carbonic acid				1·2820
Sulphate of baryta	1·187	= SO^3		0·4025
Phosphate of baryta (3 BaO PO^5)	2·147	PO^5		0·5090
Chloride of silver	2·070	Cl		0·5175
Mixed chlorides of potassium and sodium	8·460			
Potassio-chloride of platinum	23·376	= K Cl = 7·597	= KO	4·7981
Chloride of sodium (by loss)		0·863	= NaO	0·4603

Quantities of which are equivalent to:

Carbonate of potassa	4·0791	= 33·0582	p. c. of ash.
Sulphate of potassa	0·8855	7·1752	,, ,,
Phosphate of potassa (tribasic)	2·0270	16.4249	,, ,,
Chloride of sodium	0·8630	6·9929	,, ,,

The substances insoluble in water (B) gave, upon analysis:

Carbonic acid			0·4430
Sulphate of baryta	0·399	= SO^3	0·1353
Earthy phosphates, &c.	2·616		

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Perphosphate of iron	0·230	=	PO^5	0·1089
			Fe^2O^3	0·1211
Phosphate of alumina	traces			
Pyrophosphate of magnesia	1·837	=	PO^5	1·1023
Carbonate of lime	3·467	=	CaO	1·0421
Pyrophosphate of magnesia	traces	=	MgO	traces.
Silica	0·633			
Charcoal and sand	0·390			

They were therefore composed of:

Carbonate of lime	1·0070	= 8·1590	p. c. of ash.
Carbonate of magnesia	traces	traces	,, ,,
Sulphate of lime	0·2300	1·8637	,, ,,
Perphosphate of iron	0·2300	1·8637	,, ,,
Phosphate of alumina	traces	traces.	
Phosphate of lime (tribasic)	2·3860	18·2223	,, ,,
Phosphate of magnesia	traces	traces.	
Silica	0·6320	5·2451	,, ,,
Charcoal and sand	0·3900	deducted	
	4·8750	35·3538	

After deducting the carbon and sand and carbonic acid, the composition of the ash of the eddoes may therefore be stated as follows:

		After deducting CO^2
SOLUBLE SALTS:		
CO^2	10.3921	
SO^3	3·2614	3·7879
PO^5	4·0920	4·7526
KO	38·8790	45·1440
NaO	—	—
KCl	—	—
NaCl	6·9929	8·1218
	63·6174	53·8063
INSOLUBLE SALTS:		
CO^2	3·5086	—
SO^3	1·0963	1·2732
PO^5	9·8144	11·3990
CaO	15·7369	18·2774
MgO.	traces	traces
Fe^2O^3	0·9813	1·1397
Al^2O^3	traces	traces
SiO^3	5·2451	6·1044
	100·0000	100·0000

Now, if we compare the results of the two analyses just recorded with those of my former examination of potato-ashes,* we shall observe a very close resemblance between them; in fact, the ashes of all these three plants evidently belong to the same class, namely, to that in which the alkaline carbonates predominate. Reasoning from this circumstance alone then, we should be led to expect that the same species of soil would be suitable for the cultivation both of the potatoes, eddoes and batata; and such, I am informed, is the fact.

The ashes of the potato, however, we shall find, contain a much larger proportion of alkalis and phosphoric acid than either of the others; and we should hence at first be induced to believe that the former plant would prove a more exhausting crop than the eddoes or batata; but a little calculation will show us that this would be an erroneous conclusion; in fact, just the opposite is the case, as will be readily seen upon consulting the following table.

TABLE I. Showing the amounts of the several inorganic constituents removed from the soil in a ton weight of each crop:

	Batata.	Eddoes.	Potato.†
Sulphuric acid	2 lbs. 6¼ oz.	1 lb. 13 oz.	1 lb. 2½ oz.
Phosphoric acid	2 11¼	5 1	3 7½
Potassa	9 14½	14 2½	13 9
Chloride of potassium	4 2¾	— —	— —
Chloride of sodium	3 13½	2 2	0 1¼
Lime	4 1½	5 15	0 11¼
Magnesia	0 7¾	a little	0 15
Oxide of iron	0 7	0 5¾	small
Silica	0 11¼	1 14½	quantities.
	28 lbs. 15 oz.	31 lbs. 5¾ oz.	19 lbs. 14¾ oz.

* Chem. Soc. Qu. J., ii., 21.

† This calculation was made by taking the mean of the five analyses given in the paper just referred to.

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TABLE II. Giving formulæ from artificial manures required by the same quantity of each vegetable :*

	Batata.		Eddoes.		Potato.	
Pearl-ash	18 lbs.	4 oz.	19 lbs.	12½ oz.	19 lbs.	12 oz.
Epsom-salts ($MgO\,SO^3+7HO$).	3	5¼	—	—	7	10
Glauber salts ($NaO\,SO^3+10HO$)	4	0	5	1	—	—
Common salt	7	2½	2	2	0	1¼
Gypsum ($CaO\,SO^3+2HO$	4	5¼	0	13	—	—
Bone earth	5	13½	10	10	7	8¼
			or			
Burnt bones	6 lbs.	5 oz.	11 lbs.	15 oz.	8 lbs.	7½ oz.
Bones (half-inch)	9	13¼	18	6	12	9½

The relative powers of exhaustion (if I may be allowed to use the expression) of these three crops for the most important of the inorganic constituents—the alkalis and phosphoric acid—may therefore be represented by the following numbers:

	Alkalis.†		Phosphoric acid.	
Potato	217	or 1000	55½	or 1000
Eddoes	244½	or about 1126¼	81	or about 1459
Batata	233	„ 1073¾	43½	„ 779

PREPARATION AND ANALYSIS OF CODEIA.‡

BY DR. ANDERSON.

THIS alkali was obtained, as usual, from the mother-liquor from which morphia has been precipitated by ammonia. As the codeïa forms only a sixteenth to a thirtieth of the morphia, it is of course mixed in this fluid with a corresponding quantity of muriate of ammonia, which must be decomposed by potassa in order to obtain it. Much advantage is gained, however, by first evaporating the fluid to crystallisation, and expressing the crystals deposited, as in this way the greater part of the muriate of ammonia, which is the more soluble salt of two, is left in solution; and by repeating the crystallisation many times, it may be entirely removed, and crystals obtained which are pure hydrochlorate of codeïa. For the preparation of codeïa, however, it would be worse than useless to carry the process thus far, as the solubility of hydrochlorate of codeïa and ammonia differs so little, that much of the former salt would be lost; but by carrying it to a certain length, the greater part of the sal-ammoniac may be separated without any material loss of codeïa, and the subsequent steps of the process much facilitated. The crystals so obtained being dissolved in boiling water, strong solution of caustic potassa is added in excess, when codeïa is in part precipitated as an oil, which by-and by concretes into a solid mass, and is partly deposited in crystals as the solution cools. By evaporating the fluid, another crop of crystals is obtained; and finally, when the mother-liquor has been concentrated to a very small bulk, it becomes filled on cooling with long silky needles of morphia, which has been retained in solution by the excess of potassa. A certain quantity of morphia appears always to remain in solution along with the codeïa, but its quantity seems to vary considerably. Its presence in this solution has been observed before, and it has been stated that it exists in the form of a double salt with codeïa; but Dr. Anderson states, however, that this is not consistent with his experience; at least the salt separated from the muriate of ammonia by successive crystallisations contained no morphia, but, as has been already stated, was pure hydrochlorate of codeïa.

The crystals of codeïa precipitated by potassa in the manner described, are always more or less colored. They are purified by solution in hydrochloric acid, boiling with animal charcoal, and re-precipitation with a slight excess of potassa, and the precipitate obtained finally dissolved in ether to separate any morphia which may adhere to it. For this purpose hydrous ether is best adapted; and it ought to be free from alcohol, as if any be present, the ether evaporates and a syrupy fluid is left behind,

* In the construction of these formulæ, the oxide of iron and silica were not taken into consideration, as it was supposed that all soils contain these substances in sufficient quantity to supply the wants of any plant not belonging to the *gramineæ*.

† Including the alkaline chlorides, and regarding them as free alkalis.

‡ Trans. Royal Soc. Edinburgh, 1850.

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which refuses to crystallise. When the ether is anhydrous, it dissolves the codeïa, with much greater difficulty; and by evaporation small crystals are deposited which are anhydrous.

Dr. Anderson submitted the codeïa to analysis, and deduced from his results the formula $C^{36}H^{21}NO^6$, giving in 100 parts—

Carbon	72·24
Hydrogen	7·02
Nitrogen	4·68
Oxygen	16·06
	100·00

which agrees with the previous determination of Regnault.

Codeïa crystallised from water or from hydrous ether is obtained in crystals, often of considerable size, belonging to the right prismatic system, and presenting a considerable number of modifications. These crystals contain two equivalents, or 5·67 per cent. of water.

Codeïa is an extremely powerful base, rapidly restoring the blue of reddened litmus, and precipitating oxides of lead, iron, cobalt, nickel, and other metals from their solutions. It is precipitated by potassa from its salts, and is generally stated to be insoluble in that alkali; but this is true only of very highly concentrated solutions; as a considerable quantity of strong potassa may be added to a saturated solution of codeïa in water without producing precipitation; and even when a large amount of potassa is added, a certain quantity of the base is still retained in solution. Codeïa is soluble in ammonia, but not more so than in water; 100 parts of a moderately strong solution of ammonia, dissolved at 60°, 1·46 part of codeïa; and according to Robiquet, 100 parts of water, at 59° dissolve 1·26 parts. Contrary to what is usually stated, Dr. Anderson found that codeïa is precipitated from all its salts by ammonia; it does not, however, fall immediately, but is slowly deposited in small transparent crystals.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE ALLOYS OF GOLD AND SILVER USED IN THE MANUFACTURE OF PLATE, JEWELLERY, &c., WITH AN EXPOSITION OF THE VARIOUS FRAUDS PRACTISED THEREIN.

BY WILLIAM GRIFFITHS, WORKING GOLDSMITH.

LETTER VIII.

To the Editors of The Chemist.

DEAR SIRS,—In my last letter I enumerated the processes adopted by the various operators in different towns, for the production of plated gold work; I make the present communication to show the methods used for the production of silver plated work.

Almost everybody knows that the various articles of apparent silver ware used by the public, in most instances, are of plated metals; copper being the basis, with a coating of silver on the external surface; at least it was the case until the recent improvement of adopting German silver as the basis; for which the latter metal possesses very great advantages, particularly that of being nearly the same color, so that when an article of plated ware is worn through by frequent cleaning, &c., the baser metal does not offer so great a contrast to the purer one. Many of your readers may not be aware of the different treatment required to produce articles which they daily use, nor the varied and expensive machinery called into requisition for their production; and as I have now passed through the details of the manufacture of jewellery and the preparation of gold and alloys, I trust that my feeble efforts to enlighten them on the manufacture of plate may meet with the same indulgence as my former communications. It is a strange, but not less a certain fact, that though the manufacturing world has for the last century advanced in skill to a degree that may almost be styled perfection, yet the improvement made has been "not on virtue's side," as each advance, with few exceptions, is in the manipulation, the speed with which the articles are produced and the excessive economy in the use of all expensive materials; in fact, to produce sightly and attractive objects with as little genuineness as possible; and to such an extent is this system now carried that a man would almost require to serve an apprenticeship to every business practised (were it possible) ere he would be fit to venture alone into such an arena of machi-

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nation and deceit.—Now for an illustration.

Some fifty years ago, the manufacture of "good" plated work may be said to have attained perfection; at any rate, such work was made then as cannot be met with now-a-days; the proof of this assertion is, that many articles of plate of that age may be seen in use at the present time, not much the worse for its long service; certainly one-half the price of silver was paid for it, when now articles can be purchased for one-tenth that cost, and, as there is a cheap market, so unprincipled dealers will buy in it, and sell those goods again, thereby injuring the manufacturer who makes a really good article. Birmingham has been alike the spot from whence the best and the worst goods have emanated; and Sheffield has been established more than a century for, with one exception,* its undoubted superiority in the manufacture of articles of household plated ware; at present much excellent work is produced there, although the march of economy has lessened considerably the relative proportions of silver to that of copper employed, but it is in the Birmingham manufacture that the falling off may be observed, not only in the amount of superior metal employed, but also in the methods of putting the work together; that made in most instances in the latter place being nearly worthless, for either appearance or use, after a few weeks' wear.

I will now describe the methods employed by silver platers to produce some of the articles they make. A quantity of silver, perhaps weighing 100 ounces, is melted together with a small proportion of copper, about one-sixteenth, then cast into an ingot and rolled out to a certain thinness, then prepared by cleaning the surface, &c.; a piece of copper, 4 or 6, or perhaps 8 or 10 times its thinness, is also prepared by cleaning; both surfaces are then boraxed, and the two plates are sweated together by heat applied sufficient to fuse the silver on to the surface of the copper, in some instances both sides of the copper are coated with silver, in either case the oxide is removed from the surfaces with sulphuric acid, diluted, and then the united metals are rolled down to the thinness required. For the greater proportion of the work stamps and dies are used for putting the plates into the various forms for detached pieces of the articles required which are afterwards soldered together, generally with pewter solder, or soft solder, as it is usually termed, which is a compound composed of tin and lead, the seams in tubular pieces of work, and in parts which require strength in the manufacture, the workman for his own convenience hard solders the joinings with "silver solder," but this plan, though vastly superior if adopted for the whole article, would require more time and more silver, as the process of hard soldering requires the work to be made red hot, which oxidises the surface, and of necessity that oxide must be removed by polishing and thereby removing some of the silver; but when the work is soft soldered together, the heat applied is only sufficient to fuse the solder, and all the brightness left by the highly-polished dies remains on the surface, so that the labor of finishing is considerably less. Another reason for soft soldering the work together is, that the edges, or embossed portions, those which are erroneously called silver edges, are filled with lead solder; they being nothing more than sheet silver, as thin as paper (writing paper in Sheffield, and tissue in Birmingham) struck in a die; then the hollow part filled to a level with this solder, and connected with the other portions of the article with the same material; the whole piece of work is then burnished, generally by women, and is fit for the wareroom. The difference between Sheffield and Birmingham plated work is very remarkable, especially in candlesticks; in the former place, all the joinings are soldered together previous to their being filled with cement to support them from indentation, but the manufacturers of the latter town are frequently contented with merely piling one piece on the top of another, until the candlestick has reached its required height, and then pouring melted pitch into the hollow, with an iron rod in the centre; of course, it soon breaks away, or if incautiously heated it is rendered almost worthless, as no one would think it worth repairing; besides which, the joinings not being prepared for soldering in the first instance, it is almost impossible to repair them if once disunited from their bituminous support. Another remarkable fact in connection with Birmingham silver plating is, that the silver on it is so excessively thin upon the surface of the copper, that it wears off in all parts where there is a possibility of its being rubbed or reached, which is not the case with a Sheffield article, however long in use, as even in the oldest work it is invariably found bare of silver only on the outside of prominent parts, the hollows frequently being nearly in as good condition as when first made. One of the objections

* The extensive manufactory of Messrs. Bolton and Watt, of Soho, Staffordshire, near Birmingham.

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to plated ware in common use has been that of the silver so very soon wearing off the prominent parts. This is a fact easily accounted for; wherever there is a boss or a raised part on plated work, so certainly must that part have been stretched to produce that effect, and as the silver on the stretched part is essentially thinner, particularly as it is at the outside, so must it wear through sooner than the parts which have remained of the original thickness of the metals; so it becomes an evident fact that the parts which get the most wear are really the least protected. By the electro-plating process, this objection is certainly removed, even in replating old work, as by that process, the silver being held in the solution in which the article is placed, of course the deposition of metals is equal; even an advantage is gained for the prominent parts, as they being nearest the silver plate resupplying the solution, are apt to get the greatest amount, if there is any difference in the deposition. Another advantage in the use of that process is, that work can be made with a basis of German silver, which could not be done by the old plate-plating system, as German silver is too oxidisable to permit of the silver being placed on it in that way; and a still greater improvement that the work can be hard soldered and finished in form previous to its being plated, which prevents the great waste of silver inevitable by the old process. Thus, by the rapid strides which science and art are making, difficulties formerly considered insurmountable, are overcome, and some few must be content to suffer for the advantage of many.

I remain, dear sirs, yours truly,

WILLIAM GRIFFITHS.

Dublin, Dec. 10, 1850.

ON THE NECESSITY OF STUDYING THE SIMULTANEOUS CONTRAST OF COLORS.*

BY M. CHEVREUL, MEMBER OF THE ACADEMY OF SCIENCES, AND PROFESSOR OF CHEMISTRY APPLIED TO THE ARTS, ETC.

THERE are, as is well known, two systems of painting, that of plain tinting and of *chiaro-obscuro*. In the former, the colors are not shaded, nor blended in one another, nor modified by reflections, as in the second. Perspective is reduced in these kinds of paintings to an observation of mere linear perspective, and to the employment of vivid colors for the first coat, and pale or gray colors for the last. If the choice of the contiguous colors have been made in conformity with the law of simultaneous contrast, the effect of the coloring will be more striking than where the painting has been done according to the system of *chiaro-obscuro*. In admiring the beauty of the colors of those plain tinted paintings, which we receive from China, we ought, in comparing them with our own, to take into account the system by which they have been done, otherwise we might form an erroneous judgment in comparing pictures that have been painted according to such different systems.

If the system of plain tinting is more favorable to show the brightness of the colors used, it ought to be a motive for the painter who follows the system of *chiaro-obscuro* to make himself thoroughly conversant with the resources held out to him by the application of the law of simultaneous contrast.

He ought to multiply his draperies of different colors, as much as his subject allows of it, and if possible he ought to bring out his colors by well chosen and skilfully handled reflections,—thus, for instance, green or yellow reflections bring out a blue drapery; yellow or orange reflections bring out a scarlet drapery. He will give effect to the freshness of flesh colors by avoiding the contact of yellow or orange draperies, as well as grounds of the same colors. He must likewise avoid the fault, common to decorative painters, of using pink, or a light amber for the hangings of boxes in a theatre, since these colors have the serious disadvantage of giving a greenish tinge to the complexion. Before entering upon the qualifications which ought to be possessed by the patterns for hangings or carpets in order to insure the copies approaching as nearly as possible to perfection we must treat of the special points appertaining to this species of labor.

The weaver imitates objects with colored threads of a certain diameter; these threads passed round the threads of the chain of the warp, exhibit not a smooth surface, but one that is furrowed with lines, some running parallel with the warp, and deeper than the others, which are perpendicular to them. The effect of these furrows is the same that would be produced in a picture by a system of obscure lines intersecting each other at right angles. There are, therefore, the following differences between a piece of weaving and a picture:—1. That the former never presents the same fusion of colors that the painter can so easily obtain by blending or dividing

* *Patent Journal*, November 23, 1850.

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his colors, by means of a more or less viscid solvent. 2. That the symmetry and uniformity of the furrows in the weaving are unfavorable to the production of those brilliant lights and effective shadows exhibited by the painter, for while the furrows darken the lights, the salient parts of the threads which are in the shadows have the disadvantage of weakening them, by the light which they reflect. Add to this, that the painter has other resources denied to the weaver, for augmenting the brilliancy of his lights, and adding force to his shadows,—as, for instance, the opposition of opaque and glazed colors. He modifies an object of a uniform color by varying the thickness of the coat of paint laid on the canvas, as well as by the direction in which he lays on the brush. If it were possible to compose a piece of mosaic with such loose elements as the threads used in the manufacture of the Gobelin tapestry, a work of the kind would rank between an oil painting and tapestry,—resembling the latter, owing to it having resulted from the juxta-position of colored elements of an appreciable extent of surface, which is rendered brilliant by polish. Besides, the opposition of opaque and transparent elements calls to mind the contrast presented in a picture by the use of opakuo and glazed colors.

From this state of things, I conclude that in order to raise tapestry as near as possible to painting, it is necessary:—1. That it should represent objects of such a size, that the point where the spectator must stand in order to see them well should not admit of his distinguishing the colored elements from one another, nor the furrowed lines separating them. 2. That the colors should be as bright as possible, presenting the strongest contaasts. It is evident, therefore, that the patterns for tapestry should not only be correct in design, and represent elegant forms, but they should be composed of large objects, draped rather than naked, with the dress covered with ornaments rather than simple and uniform, and finally, that the colors should be varied and bright, presenting the strongest possible contrasts.

Although the rules given are applicable in many points to tapestry for furniture, and to the patterns for carpets, it may not be wholly useless to make a few remarks relative to the choice of colors,—to the number of tones of the same scale that may be used, and the choice of the subject to be represented.

For the choice of patterns for damasks (tapestry) for furniture, opposition of the grounds, with the predominating color of the designs upon them, is too often disregarded; for instance, where a wreath of flowers is to be represented on a crimson ground, the greater part ought to be composed of blue, yellow, and white flowers; if red flowers are introduced, they should border on orange rather than purple; whilst green leaves, laid directly on the ground, conduce very considerably to the beauty of the whole. Where the ground is green or dead leaf, the predominating flowers ought, on the contrary, to be pink and red.

In the pattern for a *Savonnerie* carpet, the size of the figures ought to be in proportion with the extent of the whole; attention must also be paid to the pattern on the parts concealed by the furniture, so that a figure or any other object composed of different parts (distinct with respect to design and color) may be presented to the eye of the spectator in all its details when the carpet is laid down. In a large carpet, or in one of only middling size, the figures and designs should not be too large, nor should the divisions of one uniform color cover too large a surface. In a carpet of small extent, the designs of the Persian and Turkey carpets are preferable to those which look more like a *picture;* and here we may as well draw attention to the effect produced by palms, straight or waving zones, Vandyck scallops, &c., in which yellow is contrasted with violet, orange with blue, and red with green.

Finally, in the case of patterns for tapestry and carpets, where no attempt is made to compete with the effect produced in tapestry or furniture hangings of the Beauvais style, or in carpets of the Savonnerie manufacture, a scale composed of only four or five tones of color, will be sufficient to produce a very good effect, provided the choice of the contiguous colors has been judiciously made.

EXTRACT FROM A MEMOIR ON THE STRUCTURE AND COMPOSITION OF THE SUGAR-CANE.*

BY M. PAYEN.

ACCORDING to M. Payen, sugar exists in a crystallised state, resembling sugar-candy, in all the thin-sided cylindrical cells which surround the woody bundles and vessels of the sugar-cane, from the axis of the stem to the second row of the most woody fibres.

"These cells in the ripe sugar-canes becomes yellow when washed in pure water and placed in contact with iodine, and the color is heightened by the application of sulphuric acid, which disunites the cellulose.

* *Comptes Rendus*, May, 1849.

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"When, however, the azotised matter in the small thin-sided vessels, and also the azotised and woody substances in the cells containing sugar are removed by caustic soda, several curious phenomena are produced under the double reaction of the acid and iodine; the small pitted vessels whilst disuniting, become tinged with a light blue.

"The interior of the sugar cells, the part last formed, swells rapidly, and passes to the state in which particles of disunited cellulose are found in hydrated starch. This part then, of course, is colored deep blue. The azotised corpuscles adhering to this inner layer separate from it, and are distinguished by the peculiar orange color of the light granular outline which they form parallel to the inner swollen sides of the cell.

"The outer membranes, those first formed, being more compact, are not so much disaggregated; they swell, however, form sinuous folds, and separate at places from the neighbouring cells, but still retain the orange yellow color they acquired under the influence of the double chemical action.

"If a thin slice of the sugar-cane, after being washed in pure water, is acted upon by a solution of caustic soda or potassa, all those parts of the tissues which contain woody matter turn yellow, whilst the little pitted vessels and the cuticle become semi-transparent and colorless. This shows that the latter parts contain no woody matter at all.

"The yellow color thus produced by the alkaline reaction disappears altogether if the parts so colored be washed with pure water and are then placed in contact with an excess of acetic acid. This acid renders the field of the microscope very brilliant.

"If the action of caustic potassa or soda on a thin slice of the cane be heightened by evaporating the alkaline solution almost to dryness, and the slice be then washed, it will be seen that the woody bundles have been completely separated the one from the other; the same thing happens to the little pitted vessels, which do not occupy the space they did previous to the experiment. All the other parts of the tissue when separating under the action of iodine and concentrated sulphuric acid are colored indigo blue, whence it appears that they consist of pure cellulose.

"The cellulose of the tissues of younger and less ripe canes can be purified much more quickly and by much weaker reagents. Indeed if a thin slice of the middle of a stem of a green sugar-cane, only one-third grown, be taken and treated with—1, pure water; 2, a solution of iodine in water and alcohol; and 3, with concentrated sulphuric acid, the epidermis and the cellular tissue lying next under it become colored with deep orange; the woody fibres become separated, and together with the large pitted vessels (of which there are two in every woody bundle) take and keep an orange yellow color; the small pitted vessels turn greenish blue and separate quickly; whilst the sugar cells pass from yellow to green, and then indigo violet; swelling and separating little by little.

"A portion of the lower white part, which was completely enveloped by the sheathing leaves of a young sugar-cane, and the woody tissue of which was still tender, was subjected to the same reagents. Iodine disolved in water colored the whole of its tissues, except the small pitted vessels, yellow; the addition of a drop of sulphuric acid produced a most curious and pretty effect; the outer hairs, yellow on their external cuticle and their internal granular membrane, became violet in the thickness of their swollen sides; the cuticle and epidermis of the stem acquired a deep orange tint, the subjacent cellular tissue was tinged blue in the thickness of all its cells, and the same tint was visible in the small pitted vessels, so that there was a blue cylindrical bundle surrounded by orange-yellow tissue, thus; 1st, there were the large pitted vessels with the 14 or 18 tubes adhering to each of them; then came the fusiform tissue over-lying them; and 3dly, the slightly woody fibres. In the middle of the yellow sides of the latter could be seen the inner layer of recently formed cellulose detaching itself in an irregular swollen blueish ring.

"The cells of tissue still younger than the last had all of them a roundish or elliptical nucleus of delicate azotised tissue, the diameter of which was about one-tenth of that of the cell; a quantity of granules of azotised matter adhered to the inner surface of all the cell walls. Numerous but excessively small grains of starch were visible; successive additions of iodine and sulphuric acid stained the epidermis; the woody bundles and all the azotised bodies permanently deep yellow; all the tubes, vessels, and cells swelled, became dark violet-colored, and separated from each other; the dissolution soon becoming more complete, the blue sides disappeared, bringing into view the isolated brownish-yellow epidermis and all the orange-yellow azotised corpuscles which adhered to the interior of the destroyed cellular membranes.

"Thin slices of a lateral bud whose leaves were only about an inch in length, when treated in a similar way, exhibited a bright orange-yellow color in the epidermis

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of the leaves and the axis, whilst all the rest of the tissues rapidly became violet-colored whilst being decomposed.

"Lastly, all the stems and leaves of newly formed shoots contain a great quantity of starch granules. Starch occurs in the stems principally, in the tissues lying immediately beneath the epidermis, and in the cellular tissue containing sugar situate all round the vascular bundles. The leaves also contain large quantities of starchy substances situate in the firm cellular tissue surounding the vessels of the nervures, and extending from one face of the leaf to the other.

"It has been ascertained by chemical analysis that a green cane contains half as much sugar, 30 per cent. less tissue, and three times as much organic substances and salts as a ripe one. Similar differences would no doubt explain the impossibility of extracting cane sugar with any profit in countries where, in consequence of the coldness of their climates, the cane cannot become sufficiently ripe; for it is certain that organic matters and salts present great obstacles to the crystallisation of sugar.

"The nodes of a sugar-cane are composed of a compact tissue consisting principally of thick-sided woody fibres, in which the cavities of the cells are, in consequence of their thick sides, small, and where, besides, the cells containing sugar are much smaller and less numerous than elsewhere. It is easy to understand, then, that the quantity of sugar in the nodes themselves is only about half that found in the other parts of the stem.

"Another fact, at first sight remarkable, but which might have been anticipated from the structure of the nodes, is, that they contain as much water as all the other parts of the stem put together. This is because the larger quantity of cellulose and woody incrusting matter in some parts is compensated by the smaller quantity of sugar in other parts of the nodes."

ON THE COMPOSITION OF THE MATERIALS EMPLOYED IN THE MANUFACTURE OF PORCELAIN IN CHINA.*

BY M. EBELMEN (DIRECTOR OF THE GOVERNMENT PORCELAIN WORKS AT SÉVRES), AND M. SALVETAT.

THE object of this communication was to report on the chemical examinations which had been made of the materials employed in the manufacture of Chinese porcelain, some of which were recently received from a Chinese Lazarist priest, Father Joseph Ly, who had been requested by M. Brongniart to obtain them, and others which had been brought from Canton by M. Ilier, and placed in the museum at Sévres. The first part of the communication contains the following account of the details followed in the manufacture of porcelain in China, furnished by Father Ly:—"All the materials employed in the manufacture of porcelain, are stones obtained either from the soil or detached from rocks, except the materials Kao-ling of Tong-kang and of Ly-kang, which are obtained from the soil like sand, the grosser particles being removed by treatment with water; the soft parts are collected and reserved for use. All the stony materials should be well levigated, then thrown into water, and well stirred, so as to allow the grosser particles to precipitate; the finer particles, which float in the water, are collected, dried and formed into cakes. All these pastes are carried to King-te-ching, and are kept in the houses of the workmen previous to use; they are then mixed with water, passed through a sieve to remove any small particles, and slightly dried; they are now ready for use. It must be remembered that all these porcelain materials are not obtained from the same place, but from different parts of the country, some of them at considerable distance. Some are brought from Khy-min-hien, some from Fou-leang-hien, others from Yu-kan-hien, and even from the province of Hou-pé, as the Chy-kao. It is from this circumstance, that although all the materials ready levigated and made into pastes, may be obtained at King-to-Ching, yet we may send far and wide to obtain the same materials in their rough and natural state. M. Rameaux requested me to obtain samples of these various materials. I have therefore obtained samples of twelve different materials for you. You are aware that no one material will serve the purpose of making any kind of porcelain, but that it is requisite that several of them should be mixed together. I will now proceed to give you an explanation relative to each material. The workmen informed me that some of the materials are used to form the *bone* of the porcelain, Kao-ling, from Tong-kang and Sy-kang; others to form the *body* of the porcelain, as those from San-pao-p'ong, Yu-kan-hien. If the Kao-ling materials be alone employed in the formation of articles of porcelain, they crack in the furnace, because the nature of the Kao-ling is too hard; on the contrary, if the articles be formed of the other materials, without

* *Patent Journal.*

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the admixture of Kao-ling, they melt in the furnace (as flowers fade under the heat of the sun), because their nature is too soft and weak, and they are unable to stand the heat of the furnace for twenty-four hours. In order to prepare the better and finer sorts of porcelain, 1 lb. of Kao-ling, from Tong-kang, must be mixed with 2 lbs. of material from Khymm; for porcelain of second quality, 4 lbs. of Say-pi, from Tong-kang, are mixed with 2 lbs. of Kao-ling, from Ly-kang; for porcelain of third quality, 2 lbs. of materials from San-pao-p'ong are mixed with 1 lb. of Kao-ling, from Tong-kang; for porcelain of fourth quality, 1 lb. of paste from Yu-kan-hien is mixed with 1 lb. of Hoa-chy, and 1 lb. of Kao-ling, from Ly-kang; lastly, the dregs of all the above-mentioned pastes are employed in the manufacture of the inferior porcelains."

"These details," state MM. Ebelmen and Salvetat, "exactly agree with those which occur in the manufacture of European porcelain. Here, as in China, the rough Kaolins are washed, to remove the argillaceous matter, and then mixed with quartzose, sand, and felspar, previously reduced to impalpable powder, by grinding and levigation."

The communication also contained the analyses of the materials sent by Father Ly.

MM. Ebelmen and Salvetat conclude by drawing the following conclusions:—

I. The Kaolins and the Petunste, which are employed in the manufacture of pastes for Chinese porcelain, are analogous in chemical composition to that of the materials employed to answer the same purpose in the European manufacture of porcelain. The Kaolins of China evidently proceed from the disintegration and decomposition of granitic rocks. The chemical composition of the Petunste is very nearly allied to the mean composition of the Limousin pegmatite, but the mineralogical characteristics of the Petuntse identify them with the compact or petrosilicious felspar.

2. The mechanical preparation of the materials employed in the manufacture of the pastes, appear to be based on the same methods as are employed in Europe.

3. The Chinese porcelain pastes are somewhat more fusible than those made in Europe.

4. The glaze of the Chinese porcelain is much more fusible than that of European porcelain. This increased fusibility is due to the addition of lime in somewhat larger proportion to the Petuntse, or petrosilicious felspar, which is alone used in the manufacture of French porcelain.

The green tint of the Chinese porcelains appear also to be due to this employment of lime. Everything indicates that the Chinese porcelains are baked at a much lower temperature than that found to be necessary at Sévres, and other porcelain works in France. The Chinese porcelain has from time immemorial furnished the type of hard porcelains. This name they most certainly merit, when we compare them with the porcelains with lead glazes, the manufacture of which made so much stir in France during the last century; but they are inferior in hardness to the porcelains of Dresden and Sévres, which are baked at a much higher temperature than the Chinese porcelain. The differences above mentioned between the composition of the glaze used in China and in France, explain the differences presented by the employment of vitrifiable colors on the two varieties of porcelain. All the primary materials, and all the pastes furnished us for analysis were brought from the porcelain manufactory of King-te-ching, in the Kiang-si. In this neighborhood there exists, according to Father Entrecolles, more than 3,000 porcelain furnaces, with a population of 100,000 inhabitants, where the porcelain manufacture of the Chinese empire appears to be almost entirely concentrated.

PROCESS OF MAKING MALLEABLE BRASS.*

It is known that common brass containing from 27·4 to 31·1 per cent. of zinc, and from 71·9 to 65·8 per cent. of copper, is not malleable while hot, but that articles of it must be made by casting. As it would be of great importance in many branches of industry to have an alloy of this kind that could be worked while hot, like malleable iron, the information that such an alloy exists must be welcome to artists. As far as I know, the first specimens of malleable brass came from England to Hanover, and the first account of the analysis of this alloy was published by the *Gewerb-Verein* of Lower Austria, at Vienna. The results gave a composition of 34·76 zinc and 65·03 copper, with traces of lead.

On the basis of this analysis, M. Machts, proprietor of a manufactory, made larger specimens of the alloy in question, and found that, by melting together 33 parts of copper and 25 parts of zinc, there was a loss of three parts; thus making 60 per cent. copper and

* *Verhandlungen des Vereins zur beforderung des Gewerbfleisses in Preussen*, 1849.

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40 per cent. zinc. It differs from the English specimens by containing a larger proportion of zinc, and possesses, according to M. Machts, the precious property of malleability in a higher degree than the English specimens.

A piece of *"yellow metal,"* similar in color to this alloy, was found, on analysis, to contain 60·16 copper and 39·71 zinc, which is the composition of malleable brass. It also showed great density or solidity.

I caused an alloy to be made by melting together 60 parts copper and 40 parts zinc, which had the following properties:—The color was between that of brass and tombac, it had a strong metallic lustre, a fine, close-grained fracture, and great solidity (density). Its specific gravity, at the temperature of 10° C., was 8·44; by calculation it should only have been 8·08; thus shewing that in the formation of the alloy a condensation must have taken place. Calculation shows that the alloy may be considered as a determinate chemical combination, for the results of the analysis very nearly accord with the assumption that it may be considered as composed of 3 atoms by weight of copper, and 2 atoms by weight of zinc (3Cu+2Zn). The hardness of the alloy is the same as that of fluor spar; it can be scratched by apatite (glass), consequently its hardness is =4. The alloy is harder than copper, very tough, and is, in a properly-managed fire, malleable; so much so that a key was forged out of a cast rod.

These important properties of this alloy warrant an expectation of its application to many purposes in the arts, and it would appear that they depend on its definite chemical proportions. Agreeably to the directions of M. Feyerabend, care must be taken in melting together the metals, not to permit too great a loss of zinc to take place, lest the proportion between the metals should be altered, which might not be without effect on the important properties of the alloy. With this view, it might be advantageous in practice, in place of zinc, to add, in melting, a proportionate mixture of brass to the proper proportions of copper. An alloy prepared in this way gave, on analysis, 61·44 copper and 38·15 zinc. It is very probable that malleable brass will hereafter, in many cases, be made use of instead of the higher-priced copper.

PORPOISE LEATHER AND OIL.*

The leather tanned from the skin of the white porpoise, specimens of which were exhibited at the Quebec mechanical fair, attracted general attention. The strength and the beautiful finish of the leather were much admired; it is equal in the latter respect to the finest calf skin, and in the former quality is much superior. We understand that these animals are to be found in great numbers on the banks of the St. Lawrence, and that a most profitable business might be carried on in capturing them; not only the skin, but the oil which they contain being very valuable. The specimens sent to Montreal were bought up immediately, and an order given by the Trinity House for a quantity of the oil. The exhibitor, Mr. Tetu, was awarded a premium of £10.

* *Quebec Gazette.*

TO PREPARE AMBER VARNISH.*

BY M. STILLING.

By means of this process, the amber, which melts only at a high temperature, is placed in a strong copper vessel, closed at its upper part, and luted with clay. At its lower part, in front, is a conical pipe, before which is placed a strainer, formed of a piece of iron pierced full of holes, by means of which, the amber, when melted, may be separated from the impurities which it contains. The copper vessel rests on a furnace, its conical end being plunged some centimetres into it. When the temperature is sufficiently high, the melted amber flows, deprived of its impurities, into a large copper vessel or recipient placed underneath, and about two-thirds filled with the oil to be used in making the varnish. The incorporation of the melted amber with the oil is facilitated by heat. When the mixture is complete, the other necessary ingredients are to be added. This process has been found by M. Stilling, after considerable experience with it, to possess the following advantages:—1. The amber is completely fused, without residue, and as it is contained in a closed vessel, nothing can be lost by evaporation. 2. There is no danger of fire. 3. The thick copper vessels do not, like the earthen vessels sometimes used, break and waste the contents.

TO GIVE A BLUE COLOR TO GERMAN SILVER OR ARGENTINE.†

Place a plate of the metal, 3 or 4 inches square (previously polished, so as to give it a brilliant appearance) in a vessel containing earth, and place it in communication with a somewhat strong zinc wire, then pour

* *Patent Journal.* † Ibid.

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into the vase a slightly concentrated solution of prussiate of potassa and protochloride of iron dissolved in water. The metallic plate must be completely immersed. At the expiration of a few seconds, the argentine, which is electro-negative, will be covered with a beautiful blue color, which, though it does not stand much rubbing, is yet sufficiently adherent to render the application of the process useful.

ON THE QUANTITY OF POTASSA REMOVED FROM THE SOIL BY THE CULTURE OF THE VINE.*

BY M. BOUSSINGAULT.

THE constant presence of cream of tartar in wine, and the considerable quantities of this substance produced in vine countries, have led to the idea that the vine removes from the ground a very considerable proportion of potassa. This is, however, a simple presumption; and when it is considered that we do not give to the vine more dung than to the cultivation of roots and cereals, we may be permitted to doubt that a crop of wine, so abundant as it is supposed, requires more alkali than such or such a field of our rotations.

In order to form an opinion on this subject, which has been too long left to theoretical speculations, I determined the quantity and the nature of the mineral substances removed in 1848 in our vineyard of Smalzburg, near Lampertsloch, by estimating and submitting to analysis the ashes of the matters removed from the place, namely: 1, of the branches; 2, of the grounds of the grape; 3, of the wine. The leaves remaining on the ground, it was not necessary to take account of the mineral matters which they contained.

The size of the vineyard to which these numerical details, which I present, refer, is about 170 *ares* (419 a. 2 r. 30 p. English). The soil is full of small fragments of calcareous stones.

In 1848, the quantity of wine obtained from this vineyard was 55·05 hecolitres.

The grounds of the grapes, dried in the air, weighed 492 kilogrammes; 100 of grounds, thus dried, left 6·65 of ash, or 32·72 kilogrammes in 492 kilogrammes.

The cutting of the vineyard, performed in the spring of 1849, furnished 2624 kilogrammes of branches. I may add that, in 1850, the quantity was within 100 kilogrammes of the same.

From 100 of branches, burned in the state in which they were made, 2·44 of ash were obtained, or 64·03 kilogrammes for the whole quantity. Sufficient branches were burned to produce several kilogrammes of ash.

1 litre of wine left 1·870 gr. of very white ash.

The analyses of these ashes were made in my laboratory by M. Houzeau; the following are the results:—

	Ashes of the Grounds.	Branches & acid Brnch. deductd.	1 litre of Wine.
Potassa	36·9	18·0	20·1	0·842
Soda	0·4	0·2	0·2	0·000
Lime	10·7	27·3	30·5	0·092
Magnesia	2·2	6·1	6·8	0·172
Oxide of iron, alumina	3·4	3·8	4·2	„
Phosphoric acid	10·7	10·4	11·6	0·412
Sulphuric acid	5·4	1·6	1·7	0·096
Chlorine	0·4	0·1	0·1	traces
Carbonic acid	12·4	20·3	22·9	0·250
Sand and silica†	15·3	10·9	0·5	0·006
Loss	2·2	1·3	1·4	„
	100·0	100·0	100·0	1·870

With the foregoing data, we find for the quantities of mineral substances removed in one year from the vineyard of 170 *ares* (419 a. 2 r. 30 p. Eng.):—

	Potassa.	Soda.	Lime.	Magnesia.	Phosphoric acid.	Sulphuric acid.
	kilogr.	kilogr.	kilogr.	kilogr.	kilogr.	kilogr.
In the branches	11·53	0·13	17·48	3·91	6·66	1·02
In the grounds.	12·07	0·13	3·50	0·72	3·50	1·77
In the wine	4·64	0·00	0·51	0·95	2·27	0·53
Total	28·24	0·26	21·49	5·58	12·43	3·32

Reducing this to the surface of 1 hectare (246 a. 3 r. 20 p. Eng.), we have:—

	kilogr.
Potassa	16·42
Soda	0·15
Lime	12·49
Magnesia	3·24
Phosphoric acid	7·23
Sulphuric acid	1·93

* *Annales de Chimie et de Physique*, November, 1850.

† The silica was in very small proportion.

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Contrary to the common opinion, these investigations show that the cultivation of the vine does not require more potassa than other crops; thus, in the neighborhood of the close of Smalzberg, from 1 hectare of land:—

	Alkali.	Phosphoric acid.
	kilogr.	kilogr.
The potato removes	63	14
Beetroot removes..	90	12
Wheat with the straw	27	19

TO COAT IRON WITH COPPER.*

It is well known that if a plate of iron be immersed in a solution of sulphate of copper, it speedily becomes coated with the copper in solution; but the copper thus deposited on the surface does not adhere firmly, and may readily be removed by friction. By means of the following process of M. Reinsch, the iron may be covered with a coating of copper as firm and as durable as an electrotype deposit. The process is as follows:—Polish the iron by rubbing it well with cream of tartar, and afterwards with charcoal powder, and place the metal thus polished in hydrochloric acid, diluted with three times its volume of water, in which a few drops of solution of sulphate of copper have been poured; after a few minutes have expired, withdraw the iron and rub it with a piece of cloth, then replace it in the solution, to which add another portion of sulphate of copper. By following on this plan, and adding at each immersion a new supply of sulphate of copper, the layer of copper may be increased at pleasure. Lastly, introduce the iron thus coated with copper, into a solution of soda, then wipe clean and polish with chalk. The coating thus obtained will be as firm and durable as that deposited by the electrotype process.

NEW SYMPATHETIC INK FOR "CHEMICAL LANDSCAPES."

BY T. W. NAYLOR.

Amongst all the numerous salts hitherto discovered, there appear to be but four which can be successfully employed in the production of those beautiful effects exhibited by the well-known "Chemical Landscapes;" paper brushed over with solutions of the following substances assumes, on the application of a gentle heat, the colors affixed to their chemical names:—

Acetate of cobalt..... Azure blue
Bichloride of copper .. Gamboge yellow
Protochloride of cobalt Olympian green
Bibromide of copper... A fine brown.

These chemicals, at ordinary temperatures, have so little coloring power, that papers washed with their saturated solutions are nearly colorless: it is only on holding them before the fire that the beautiful colors develope themselves, and, as the paper cools, so gradually will they vanish from the eye; those illusive and spectral tints, therefore,

"Come like shadows—so depart."

The chemical landscape has been known for a great number of years; one of the best subjects is a *snow scene*, which you may manage thus:—Procure a colored lithograph or engraving (or draw a picture yourself) representing a winter prospect—the boughs fringed with the effects of the frost and snow—the waters iced and uneven—the cotter's home thatched with snow—everything should denote winter in its most piercing character. You must now touch the foliage, in some parts, with bichloride of copper (yellow), while others, again, will require the protochloride of cobalt (green); some parts of the distance, trees, water, flowers, &c., may be done with the acetate of cobalt (blue). My new material is the bibromide of copper (brown), which will be found useful for shading, obliterating icicles, adding deep masses of foliage, &c., &c. Now, on holding the picture at a moderate distance before the fire, the fields resume their verdure—the flowers their bloom—the waters their placid surface—the trees their foliage—everything is decked in cheering summer array. This pleasing and really *inexplicable phenomenon* may be reproduced *ad libitum*.

The introduction of the bibromide of copper affords the means of putting entirely new features into the picture—men, cattle, trees, buildings, &c., because you can make a *distinct dark outline*, invisible in the cold. You can even produce on plain paper a *Magic Picture*, appearing only on being warmed, being executed with the chemical solutions *alone*, without any previous pencilling or engraving.

I prepared the bibromide of copper myself: those not conversant with the manufacture of chemicals should purchase it of some operative chemist.

* *Patent Journal.*

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ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in artificial stone, mortar, and cements, and in the modes of manufacturing the same. JOSEPH GIBBS, of Devonshire Street, Portland Place, civil engineer. Patent dated May 7th, 1850. Enrolled November 7th, 1850.

The improvements described in this specification relate to the manufacture of cements and artificial stone; the specification is divided into three parts—

First—The manufacture of mortar and cements, by the employment of materials hitherto not used for the purpose.

Secondly—The manufacture of artificial stone for building and other purposes.

Thirdly—The construction of kilns, and mode of burning and calcining the materials.

The patentee proposes the employment of materials, which have not hitherto been used for manufacturing cements. In the ordinary cements manufactured, the color of the whole of them is more or less of a dark brown, which, when employed to represent stone, is totally unfit for that purpose, without applying to the surface of the plastered cement a coating of whitewash or paint, the cement itself being much too dark in color. The ordinary Roman cement is manufactured from various materials, principally from the septaria of Harwich, or that of the Isle of Sheppey. The septaria of the lias formation is sometimes employed, and also the materials from the beds of cement stone in the upper division of the lias formation, and the shale beds of the Kimmeridge clay. These produce a good cement, but much too dark in color to represent even the darkest description of stone. The cement manufactured, and known as Portland cement, is of a much lighter color, and represents, in appearance, some descriptions of stone, but the cost of production renders it too expensive for general use. This cement is manufactured by combining clay and chalk, or river mud and chalk, and mixing them in such proportions that the mixture shall contain the requisite quantities of lime, silica, and alumina. These materials are ground and powdered by proper machinery, mixed with a large quantity of water, and after standing for a short time and subsiding, the water is drawn off, and the pasty mixture is then dried by artificial or natural heat, for driving off a large proportion of the water. It is then submitted to a calcining process in a suitable kiln, from which it is taken and again ground to a powder, and has now mixed with it slag, from copper smelting and other furnaces, previously reduced, by grinding, to a state of powder. The proportion of ground slag to be mixed with the calcined materials will depend upon the nature of the materials employed, and the nature of the cement to be produced; but this proportion will range from one-third to one-half weight of slag. The improvements of the patentee have for their object the production of cements of a much lighter shade of color than those usually employed, suitable for building and other purposes, to represent stone, without the necessity of coating it with any substance, as whitewash or paint. The substance and materials which the patentee proposes to employ for this purpose, producing several kinds of cements, are the chalk marls, the calcareous marlstone of the Ashburnham beds, the calcareous shales of the Purbeck formation, the runnel bed of lias, from the mountain limestone shales, what is known as bastard limestone, the lower shale, and the pyritous nodules or septaria of the coal measures. The patentee enters into a long geological description of these several substances,—their localities and peculiarities; they are all however, capable of being manufactured into cements more or less hard, and of a much lighter color than the old Roman or Portland cements, and adapted for building purposes, to represent stone, without covering. The cements produced from some of these materials are, however, of too soft a nature to be employed in the state manufactured. In those cases, the patentee hardens them by the admixture of other cements or materials, which he calls hardening. The substances which the patentee employs for hardening are the sparry ironstone, the white ironstone of mountain limestone, pyritous earth, and the pyritous septaria of the coal measures. These substances, when calcined, ground, and treated separately, produce cements that are very hard, and for that reason the patentee employs them to mix with softer materials, and by the combination produces effective cements. These hardening substances should be calcined and ground by themselves, and then combined with the other cements, with which they are to be mixed; or the materials may be mixed previous to that operation. These substances may also be employed for mixing with ordinary cements, made in the usual manner, for the same purpose, and with like effect.

The second part of the specification

* *Patent Journal.*

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describes improvements in the manner of producing and manufacturing artificial stone, from any of the above cements, either employed alone or mixed with other materials. The cementitious materials are ground and pounded to a powder, by means of proper mills, edge stones, and other apparatus, and then consolidated into solid blocks or cubes, or any desired shapes. The method which the patentee adopts for effecting this consolidation is by means of concussion, employing for the purpose heavy hollow hammers, which are caused to fall with heavy blows upon a solid unyielding body; the cementitious materials being previously placed in the hollow recesses of the hammers, when the effect of concussion is to consolidate the materials into an exceedingly dense mass, which, upon becoming finally set will be very hard. The patentee also employs another mode of consolidating the cementitious materials, namely, by employing very strong metallic vessels, the interior or hollows of which are of the form and size which it is desirable the consolidated mass shall have; these are filled with the cementitious materials, and the vessels are then allowed to fall from a height on to a solid unyielding base, as before. The concussive effect of the blows will consolidate the materials to a great degree, producing when quite set a very hard and solid substance. The indurated blocks and masses thus manufactured bear a strong resemblance, both in hardness and color, to free and other stones, and may be employed for most purposes to which stone is applicable.

The cementitious materials which are to be manufactured into artificial stone, blocks and masses in the above manner are to be previously prepared in a peculiar manner. The cement, whether wholly of any one of the above described, or whether composed of a mixture of two or more descriptions of materials, is to be well ground and mixed with water; but the proportions of water employed is not so large as is usually used in the manufacture of artificial stone. The cementitious materials thus mixed with water is then placed in a mortar, or other suitable receptacle, and subjected for a considerable time to a heavy pounding or beating action, considerable force being employed in this operation, as upon this being most effectually performed much of the success of the manufacture depends, as the greater the force of the pounding, and the length of the operation, the more indurated the manufactured mass will become upon setting. After the concussive operation with the hammers, or with falling vessels, has been performed, the masses should be allowed to remain in this state some little time before they are removed for the purpose of completing the setting.

The specification describes two modes of building and constructing walls, the first of these is as follows:—Two lattice frames of light wood are provided, each to be of the extent the walling is to be. These are set up a distance asunder, a few inches less than the thickness of the wall is to be when completed; the space between the lattices are then to be filled with concrete, made in the ordinary manner, but employing any of the cements described in this specification instead of the lime commonly used. Part of the semi-fluid cement, when thrown in between the lattices, will exude through the openings in the lattices, and thereby bind them to the concrete; the concrete is to be thrown in in layers of about six inches thick, and allowed to set tolerably before the next layer is applied. This being done, both surfaces of the wall is now to be plastered with any of the cements described, effectually enclosing the lattice framing, and forming a wall of one entire mass. The bars or strips of wood composing the lattice need be but very light; the specification states only about one-quarter of an inch thick, and about one-and-a-half inch broad, or ordinary laths may be employed for the purpose, or, if more desirable, the lattices may be dispensed with altogether, and the wall built without. The other method of constructing walls, by the employment of blocks or masses of indurated stone, manufactured as before described is as follows:—The wall is built of these blocks in courses, and when each course is laid, the interstices and the hollows of the blocks are filled with the concrete, by which the wall will be as one mass.

The third part of the specification relates to the construction and arrangement of kilns and furnaces for calcining the substances employed in the manufacture of cements. The first of these consists of a kiln, constructed with the bottom containing a number of vaults, which cover the whole surface; the fires or furnaces are contained in these vaults, and the heat from them circulates through all the vaults, and the body of the kilns. To allow of this circulation, the vaults are constructed with bricks of peculiar form, having hollows upon their sides, so that when placed together there are apertures through which the heat passes. By this mode of constructing kilns, the heat is equally disseminated throughout, and the contents of the kiln equally calcined.

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The second mode of construction is an arrangement for a reverberating furnace, having a vault beneath it, into which the calcined substances are received after the operation.

The third mode of construction is a circular or continuous kiln; this kiln is disposed between two circular walls, one of lesser diameter than the other, and the calcining operation is carried on continuously,—the calcined substances being withdrawn from one portion of the circle, and a fresh charge supplied at another part.

The patentee claims:—

First—The manufacture of cements and mortars from chalk, marls, calcareous marlstones of the Ashburnham beds, the calcareous shales of the Purbeck formation, the runnel beds from the mountain limestone shales, the bastard limestone, and the lower shales and pyritous septaria of the coal formations, by calcining, grinding and treating them as described, whether combined or not with other materials and substances, for the purpose of hardening them. The application and use of the hardening substances described for combining with the cements above described, or when used in combination with common cements manufactured in the usual manner, or with the chalk, marls, or marlstones in their natural state. The application and use of pyritous earths, the sparry ironstone, or the white ironstone, and the pyritous septaria of the coal measures, to any artificially formed and manufactured cements from chalk, lime, and clay, for the purpose of hardening such cements. And the mixture and combination of any of the above described manufactured cements, or chalk, marls, or marlstones, or pyritous septaria of the coal measures with each other, or with common and ordinary cements.

Secondly—The process of grinding, pounding treating, and mixing the cements, or mixtures of them as above described. The mode described of consolidating the cements, or mixtures of them, by means of concussive force, for the purpose of forming solid blocks and forms, and manufacturing artificial stone. And the method described of forming artificial stone, as walls, &c., by placing concrete or plastic cements, and other substances between lattices; and also by means of hollow parallelograms of artificial stone or cement, connected together by concrete of cement, and other substances.

Thirdly—The application of a kiln constructed with fire vaults over the whole area of the bottom of the kiln, built in such manner as to have a communication through all the vaults by passages between the bricks, for the purpose of calcining cementitious materials. And the employment and construction of a circular or continuous kiln, for the purpose of calcining cementitious substances, as described.

Improvements in the dyeing process in calico printing and dyeing, which improvements are also applicable to other processes in printing and dyeing. SIMON PINCOFFS, of Manchester, merchant. Patent dated May 23, 1850.*

In commencing his specification, Mr. Pincoffs observes that the ageing or oxidising process has been hitherto performed by exposing the dyed and printed fabrics to the action of the air, generally without, but in some cases with, artificial means for hastening the operation. In the former case, the process is necessarily as variable in its effects as the weather itself—while in the latter, owing to either an excessive or insufficient supply of heat and moisture, the effects produced are equally uncertain.

Now with regard to this ageing process, the improvement proposed is—to construct under the ageing room a compartment or chamber about twelve feet square, supplied with an entrance door, and having in its sides near the door, flaps for the admission of air, and communicating with the ageing room above, by forming the floor of the latter immediately over the regulating chamber of lattice-work; within this chamber is to be placed a wooden or iron vessel of about four to ten feet diameter, and three or four feet deep, furnished with an overflow pipe at about a foot from the top. The ageing room itself, if slated, must have the inside of the roof lined with wood or felt, and be supplied with ventilating chimneys. Before commencing the operation of ageing, the printed cloth is to be hung in all parts of the room except immediately over the regulating chamber, and the temperature of the room raised by steam or otherwise to about 78° Fahr. Steam is then admitted through a pipe closed at its emission end, but perforated with numerous holes, to the iron vessel, previously filled with cold water until the temperature rises to about 185° Fahr. On opening the flaps, the admitted air will rise into the ageing room in a heated and moistened state.

The temperature most desirable to be maintained in this room has been previously stated to be about 78° Fahr. This may be tested by an ordinary hygrometer, but with greater facility and accuracy by placing the bulb of a thermometer in a gilt or polished

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*Collected from *The Mechanics' Magazine.*

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brass cup about the size of a drinking tumbler, containing boiling water. If on pouring in cold water, condensation of the moisture in the atmosphere of the ageing room takes place before the temperature is reduced to 68° Fahr., then more cold air must be admitted; but should the temperature of the brass cup be lowered still more before condensation ensues, then the heat of the ageing room must be raised until the "dew" or condensing point is at 68° Fahr.

In order to collect the acetic acid displaced in the ageing process, Mr. Pincoffs employs troughs or perforated tubes attached to the ceiling of the room. These troughs meet in one common centre, where a fan or blower, worked by hand or power, condenses the acid, and further by acting as a ventilator, materially assists the dyeing process, which under this new system occupies only two days and nights, whereas formerly five days and nights was about the minimum. In some cases the acetic acid may be collected by means of a base or substances capable of combining with it.

Claims.—The introduction of heated and moistened air into the ageing room or rooms, and also the method described of ascertaining and regulating the "dew" point in a speedy and effectual manner.

2. Collecting the acetic acid either by condensation or by combining it with a base or with some matter or substance capable of entering into combination with it.

Improvements in dissolving caoutchouc (India rubber) and gutta percha. GUSTAVE EUGENE MICHEL GERARD, of Paris, France. Patent dated May 7, 1850.

The object of this invention is, by the employment of certain specified solvents, to produce solutions of India rubber and gutta percha which shall be perfectly plastic, but non-elastic, and which, on evaporating the solvent, shall return to their natural state. For this purpose, the patentee employs sulphuret of carbon, chloroform, sulphuric ether, naphtha, spirit of turpentine, &c., in combination with from five to fifty per cent. of alcohol, or spirit possessing similar qualities, such as spirits of wood or potatoes, which he mixes with the material to be dissolved in certain proportions varying with the thickness of solution required. India rubber is dissolved in one or two days, and gutta percha (which is warmed in the process) in from two to four. The alcohol introduced into the body of the material entirely disintegrates and destroys the cohesion of its particles, thus allowing any impurities to settle or float on the surface, on removing which the caoutchouc or gutta percha is found in a perfectly pure state.

The patentee observes that the principle of his invention is the causing of certain materials to be introduced into the body of the rubber by means of a solvent, these materials having the property of disuniting and destroying the adhesion of the particles of the rubber, and being employed either separately or in combination with a solvent.

Improvements in the manufacture of oxide of zinc, and in making paints from the oxide of zinc. EVAN PROTHEROE, of Austin-friars, London, merchant. (A communication.) Patent dated April 30, 1850.

The improvements above referred to and claimed in the specification, are as follows:

1 and 2. An arrangement of apparatus, consisting of a reverberatory furnace, in which the zinc is melted, and two retorts, in communication with each other, into which the metal flows; so that a constant clean surface of melted zinc is kept submitted to the action of currents of atmospheric air, the heavier portions of the oxide thus produced being raked out of the retorts, and falling into a chamber underneath, thence to be removed either in a box on wheels into which they fall, or by means of shovelling; the lighter portions passing up a shaft, and being thence driven by a current of steam to the condensing chambers, in which the vapor passes through a series of frames on which the oxide is deposited, the air passing off through suitable chimneys. By tilting these frames, the oxide falls to the bottom of the chambers, and may be removed by any of the means ordinarily in use. These chambers are kept cool by means of water playing on their exteriors.

3. Bleaching the light oxide by means of water acidulated with sulphuric or acetic acid.

4. Grinding and compressing of the oxide of zinc by means of a suitable mill. This mill consists of a conical roller revolving in a circular trough. This roller is placed on its side, with its narrowest diameter at the circumference of the trough. Underneath the trough is a chamber, into which the oxide falls after being ground.

5. The manufacture of oxide of zinc into paints, by combining the same with certain specified materials, in order to facilitate its drying.

This patentee employs umber, which is first dissolved in muriatic acid over a fire, and then concentrated to the consistence of

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butter or honey. To this is added resin, and the substance thus formed the patentee calls resinate of umber. This resinate, when mixed with the oxide of zinc, forms a quickly-drying paint. Instead of the resinate of umber, umber in its native state may be used but not so advantageously. Another preparation to be employed in combination with the oxide is composed of one part umber treated as above, two parts chalk or carbonate of lime, and four parts resin from the yellow pine. In addition to these, the patentee proposes another mixture, which he terms resinate of lead white; oxide of lead dissolved in acetic acid being substituted for umber, and prepared in a similar manner.

Improvements in treating coal, and in the manufacture of gas, and also in apparatus for burning gas. GEORGE MICHIELS, of London, gentleman. (A communication.) Patent dated April 30, 1850.

This patentee specifies and claims various improvements in treating coal previously to its being converted into coke, and also for use as fuel, and in recovering the various products resulting from these processes. For example; in mixing anthracite coal with bituminous, both are first reduced to powder, and cleansed by washing them with water, or by applying a jet of air to separate the light from the heavy and impure portions. For this purpose two hoppers are placed side by side, and the coals mixed in the proportion of 15 per cent. of bituminous coal to every hundred parts of anthracite, by means of valves revolving at different speeds in the bottom of each hopper, the bituminous coal-dust being intimately mixed with the other by a stream of air forced against it during its fall. The coke produced from this mixture is stated to be of superior quality, and the products which are obtained by the condenser attached to the oven are recovered by means of sulphuret of lead (galena) reduced by roasting to a state of sulphate and oxide, and then washed in the ammoniacal liquors, which yield sulphate of ammonia in the proportion of about 16 lbs. to the ton of coal. When powdered bituminous coal is used alone, coke of superior quality is likewise produced, and the resulting products, ammoniacal water and hydrocarburets recovered, in the case of the ammoniacal water, by a process similar to that above described; and the hydrocarburets by heating, and then bringing them in contact with steam, by which they are purified, and yield part of their carbon to the steam, which deposits it in the form of a very dense oil. Coals of tertiary formation—such as Bovey, Kimmeridge, and Brora coals—which contain 25 per cent. of water,—the patentee treats by heating in hermetically closed vessels, and then applying a jet of steam, which dries the coal and carries off the hydrocarburets to be purified, as above described.

Under that branch of the specification relating to the "manufacture of gas," the patentee claims the purification of gas by means of sulphate and oxide of lead, which, when exhausted as purifiers, are to be washed with ammoniacal water, when they can be reconverted by roasting to sulphurets, and made available for purifying purposes. And also improvements in the conversion of coal tar into gas of a very rich quality.

The third part of the specification relates to a new construction of burner to be used in combination with an improved regulator, by means of which the supply of gas can be equalised, and also a new construction of gas stove, fitted with a transparent plate, so that the attendant may be able by observing the color of the flame to ascertain exactly the proper time for increasing or diminishing the supply from the regulator, which is the same as used in combination with the burner, and which can be employed either in conjunction with or independent of a gasometer.

Improvements in the treatment of a substance produced in soap-making, and its application to useful purposes. ALFRED GEORGE ANDERSON, of Great Suffolk Street, Southwark, Surrey, soap manufacturer. Patent dated April 20, 1850.

In preparing alkaline ley for soap-making there is produced a sediment, known by the name of "soaper's waste ashes" or "soaper's waste," which has been hitherto considered and treated as useless; in many cases the manufacturer even paying for its removal. This sediment, however, consists principally of carbonate of lime with a small portion of alkali, and a considerable quantity of quick lime; and from it the present patentee proposes to manufacture "whiting," or "whitening." This he effects by placing the sediment in a proper vessel, and nearly filling it with water. The whole is then well stirred together till the carbonate of lime and other matters are well held in suspension in the water, which assumes a milky appearance; and after allowing the grosser particles to subside for a minute or two, this liquor is drawn off and allowed to settle. As the quick lime constituting a part of this sediment has to be removed by

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washing with water, and this is a troublesome process, it is proposed to add sufficient carbonated alkali in solution to convert all the quick lime into a carbonate. After removing this alkali by washing, the residuum is to be collected and dried, when it may be used as whiting or applied to any purpose for which carbonate of lime is suitable. The alkaline water, when drawn off, may be advantageously used in preparing fresh ley.

Claim.—The manufacture of pure neutral carbonate of lime, and the substance known in commerce as "whiting," or "whitening," from soaper's waste ashes or soaper's waste, without restriction to the above detailed method of manipulation.

Improvements in manufacturing and refining sugar. FRANK CLARKE HILLS and GEORGE HILLS, of Deptford, Kent, manufacturing chemists. Patent dated June 1, 1850.

These improvements consist in the employment of sulphite of lead, to abstract the sulphuretted hydrogen or hydrosulphurets of earths employed in refining sugar. The sugar is to be kept at a temperature of about 180° Fahr., and the sulphite of lead, reduced to a creamy consistence by the addition of water, to be stirred in till the hydrogen or hydrosulphuret is absorbed, which may be tested by acetate of lead. In some cases carbonate of lead and precipitated protoxide of iron may be substituted for the sulphite of lead.

Claim.—The employment of sulphite of lead, carbonate of lead, and precipitated protoxide of iron, for extracting from sugar the carburetted hydrogen or hydrosulphurets of earths employed in the process of purifying such sugar.

Improvements in treating fatty, oleaginous, resinous, bituminous, and cerous bodies, in the manufacture and application of them, and of their component and subsidiary products, together with the apparatus to be employed therein, to new and other useful purposes. WILLIAM RADLEY, chemical engineer, and FREDERICK MEYER, oil merchant, both of Lambeth, Surrey. Patent dated May 25, 1850.

This specification, which the patentees justly style a "voluminous" one, is divided into eight "capitals," each of which is again subdivided into sections. We give the heads of the invention, which will suffice to convey a general idea of the various improvements described and claimed by them.

1. The depuration and debasement of oils and fats, the distillation of the debased oils and fats, and the application of the results of these several processes to lubrication, combustion, and saponification.

2. The procuration of oils and adipose matters from bones, animal flesh, the refuse and offal of slaughterhouses, fish-blubber, &c.

3. The production of insoluble soaps of lime, baryta, strontia, alumina, magnesia, and metallic oxides, generally and respectively, in combination with oily, fatty, and butyraceous bodies, or any of them; their depuration from glyceric and butyric acids, and decomposition, with the formation of soluble soaps applicable to general purposes, and of "candle block" to the manufacture of candles, whilst the economised glycerine is devoted to various useful applications which are enumerated.

4. The acquisition and use of "elaiostearine," otherwise "stearoptine," or the fatty matter from the berry or beans of the "theobroma cacao" or cocoa-yielding fruit, and the application of the subsidiary "marc" from which the oil has been expressed to the manufacture of powders or pastes of cocoa, chocolate, and broma of a new kind, denominated "bromage," whilst the expressed fatty or oily matter, called by the patentees "theobromine," is applied to the manufacture of candles and other useful purposes.

5. The purification and adaptation of glycerine and lypine, the hydrated oxides of glycerule and lypule, together with alkaline, earthy and oxydic glycerates and sulphocarbono and phospho-glycerates to new and useful purposes.

6. The production of a series of compounds from the component acids of fatty, resinous, oleaginous, bituminous and cerous bodies, or their derivatives, by double decomposition, and alkaline, earthy or metallic salts, or by the combination of them, or any of them, with the bases of such salts, generally and respectively, together with the application of such products either *per se* or in combination with other resinous, oleaginous, fatty, bituminous and cerous bodies, or any of them, to the manufacture of atmofuge and hydrofuge compounds to be employed as lackers, japans, and varnishes, in making printer's ink, smear cloth for pistons, &c., and for various other purposes.

7. The combination of organic acids with alkaline, earthy, and metallic bases, and of organic coloring matters with these several bodies, and their application *per se* or dissolved in suitable menstrua, to the purposes of printing, calico-printing, paper, leather,

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and wood staining, dyeing, and polychromatic embellishments generally.

8. This division contains descriptions of apparatuses employed in carrying out parts of the invention, such apparatus being denominated respectively the "aëro-dynamic extractor," the "atmo-dynamic extractor," and the "electro-depurator."

Improvements in the disoxygenation of certain bodies, and the application, separately or simultaneously, of the products therefrom to various useful purposes. GUILLAUME FERDINAND DE DOUHET, of Clermont, Ferrand, France, gentleman. Patent dated June 1, 1850.

Claims.—1. The fabrication of hydrosulphurets by the disoxygenation of various sulphurets, either by means of the humid or the dry process.

2. The application of the hydrosulphurets of soda, potassa and ammonia to the washing and cleansing of woollen and other fabrics, and of the two first-named products to the manufacture of soap, and of artificial soda and potassa.

3. The manufacture of colors, suitable for oil, varnish, and spirit of turpentine painting, by the disoxygenation of metallic sulphates and their decomposition, by means of soluble hydrosulphurets, such as those of soda, potassa, and ammonia, or insoluble hydrosulphurets, such as those of barium, strontium and calcium.

4. The employment for the purpose of water-painting, of colors produced by the disoxygenating process, and having a double alkaline and metallic base.

5. The application of the hydrosulphurets of barium, strontium and calcium, in combination with white oxide of zinc, to be employed as a paint.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ARISTOTLE AND THEOPHRASTUS.*

BY M. CAP.

(*Continued from page* 138).

ARISTOTLE was impressed with the idea that all natural beings constitute an uninterrupted progressive line, from simple to compound, and even that this series passes from inanimate beings to vegetables and animals. He compared with plants certain marine animals and some insects from which several limbs might be removed without terminating their existence. He thought, according to the doctrine of the period, that vegetables were warm and dry, because they are born of the earth, and the sun is their father: it is for that reason, he adds, that the most fragrant flowers and the most delicious fruits grow in the hardest soils and most exposed to a burning sun.

This philosopher studied deeply the writings of Hippocrates, and possessed an extensive knowledge of medicine. Diogenes attributes to him several works on therapeutics which are now lost. Some good practical precepts occur here and there in his writings; he also gave some useful information as to the manner in which medicines act.

But, immense as is the history of nature, this enterprise could not suffice for the ardent, universal and indefatigable genius of Aristotle. Exercising in turns his meditations on each of the branches of human knowledge, he seemed to embrace the whole of them in his vast mind. Starting from the heights of philosophy and metaphysics, he arrived at physics properly so called, at zoology, botany and medicine. It was still reserved for him to throw light on a great number of points perfectly foreign to his first studies, and to give to human reason, the sciences, letters, and the arts, a code of eternal, imperishable precepts. Thus he wrote on politics, of which he laid down the general principles, comparing the constitutions of all the governments known at his period. In his poetics he established for the first time the theory of the arts, reduced to a single principle, the imitation of nature, and fixed the true rules of taste, from the writings of Homer, the chefs-d'œuvre of tragic art among the Greeks, and the best works of contemporaneous poets. His rhetoric contains the most enlightened views and the most wholesome ideas on all kinds of literature, and we find in it the germ of all that has since been written on letters and the arts, regarded from a general point of view. In his logic,

* *Journal de Pharmacie*, October, 1850.

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he regulates the progress and processes of reasoning, lays down a sure road to it, and pursues the sophism into its most specious windings. His morality presented an analysis full of minuteness and acquaintance with all the natural inclinations of the human heart, with all virtues and all vices. In a word, in the sciences, he collected an incalculable treasure of facts and observations; he laid the foundations of natural history and comparative anatomy; he extended and perfected physics: in philosophy, he created logic, and proclaimed the principle of human knowledge, established the theory of the arts, elucidated politics and morality, and established throughout principles which will always be regarded as among the most beautiful results of the efforts of the human mind.

The genius which raised monuments so prodigious and so various was indisputably one of the most eminently philosophical that has ever appeared. The most striking characteristic of Aristotle's genius was, indeed, his faculty of generalisation. He observes with care, compares with sagacity, and constantly seeks to connect isolated facts at general points of view. His style, as remarkable for clearness and precision as for abundance of ideas, bears the impress of this generalising turn of mind. He never wrote anything useless. His language is that of an elevated reason, but cold and without enthusiasm. It is simple, exact, correct and full of matter. In his writings, judgment and experience are far more predominant than imagination. Less graceful and recherché than that of Plato, less elegant, but as pure as that of Theophrastus, it may be regarded as the model of the philosophical style, and of the art of expressing general principles, like the most explicit details of science.

The destiny of Aristotle, his writings and his school, is worthy of remark. Almost deified during his life, statues were raised to him, and his countrymen instituted triumphal feasts in honor of him. But very soon after his death, alterations were made in his doctrine; Theophrastus, his pupil and most immediate successor, was almost the only one who preserved it in all its purity. Either because other schools and other professors, having in their favor the advantage of actuality, attracted to themselves all the attention of their contemporaries, or because the admiration of men, with its accustomed versatility, became tired of the success of the peripatetic school, it is certain that the writings of the philosopher of Stagira gradually fell into oblivion. They seemed not to be remembered until the period when the Romans began to occupy the ranks of philosophy: However, his doctrine did not recover its true favor until the time of the Arabs, who, during the middle ages, introduced it into Europe. From this moment it was adopted generally and exclusively; it penetrated into all nations and was taught in all the sciences, to such an extent that during twenty centuries, according to the expression of Laharpe, "the limits of the mind of Aristotle appeared to be the limits of the human mind."

It is not under the puerile pretext that Aristotle exercised pharmacy or practiced medicine, that we have dwelt, somewhat lengthily, perhaps, on the life and writings of that eminent man, but because, in the first place, the extent and variety of his knowledge and of his discoveries did not admit of his being spoken of very briefly, and because, on the other hand, it was important in connection with our subject to prove that the true origin of the natural sciences dates from the peripatetic school. That which Aristotle did for zoology, Theophrastus continued for vegetables and partly for the mineral kingdom. It must not therefore be considered surprising if we ask for these two philosophers in an equal degree, the acknowledgement of men who see in the history of nature the foundation of all the experimental sciences, and in particular of all those which are connected with the various branches of the healing art.

II.—THEOPHRASTUS.

Observations, however numerous they may be, when their sole object is an immediate application, or when, without being connected together by general ties, they cannot be employed for showing analogies, cannot constitute a science. Thus the first uses which man made of vegetables, with the view of providing for the wants of his existence, must not be considered as the origin of agricultural science, and the researches of Chiron, Orphœus, Melampus and even of the Asclepiades, to find medicaments in plants cannot be regarded as the true starting point of botany.

Indeed, the ideas of Pythagoras on the relations of animals and plants, the discovery of the sexes of plants by Democritus, or by Empedocles, and the general notions collected by some rhizotomists, were like the preludes of the development of this part of natural history; but it is evidently to the labors of Theophrastus that the true origin of the science of vegetables must be attributed, not only because he presents the most extensive catalogue of plants known

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in his day, but because he was the first who threw a philosophical aspect over the whole vegetable kingdom, because, penetrating into the details of the structure of plants, he discovered the actions of their various organs, the conditions of their existence and the laws of their reproduction, and thus laid the foundation of an entirely new science—vegetable physiology.

This philosopher was born at Eresos, in the island of Lesbos, towards the end of the fourth century before the Christian era.* He was the son of a fuller named Melanthus, and his real name was Tyrtamus: Theophrastus was only a surname given to him by Aristotle on account of the elegance of his elocution, and signifies *a man of divine language*. Having come to Athens when very young, he attended first the lectures of Plato, and then those of Aristotle, whose most brilliant pupil he soon became, and, in consequence, his most devoted friend. When the Stagirite, persecuted in Athens, resolved to retire into Chalcedon, it was Theophrastus whom he chose to succeed him at the Lyceum. The peripatetic school prospered so well in the hands of its new chief, that his lectures frequently collected two thousand auditors. The persecution, from which Aristotle was removed by retreat, could not fail to reach his successor, but the accusations brought against him raised such general indignation that they fell on the accuser, whom the philosopher had the generosity to protect from the resentment of the Athenians. Afterwards, a law having closed all the schools, Theophrastus was included in the proscription; but, in the following year, the law was repealed, and the professor reappeared amongst his pupils, who were more desirous than ever of profiting by his learned lectures.

Theophrastus passed through a long and glorious, and entirely philosophical career. He twice succeeded, by his eloquence, in delivering his country from tyrants who desired to enslave it. Free from ambition, avoiding honors and power, he exercised no public function, although he was the master and friend of Demetrius of Phaleros, who for a long time governed Athens; he rejected the bounty of Ptolemy, son of Lagus, who wished to attract him to Egypt, and accepted from Cassander, King of Macedon, only marks of his consideration and esteem. The life of this celebrated man was therefore entirely devoted to practical philosophy, to study, to instruction, and to the composition of his numerous works. He died at the age of 85 years.

The genius of Theophrastus was not less universal than that of Aristotle. He embraced in his meditations almost all the parts of the exact and speculative sciences. We find in Diogenes the list of two hundred and twenty-seven works which he wrote on grammar, logic, dialectics, oratory, physics, natural history, the mathematics, poetry, music, morality and even comedy. Unfortunately most of these works are lost to us. All that remains is reduced to two treatises on the history of the vegetable kingdom, a treatise on stones, a small number of writings on physics and medicine, and some fragments of moral works, known under the name of *Characters*.

One of his treatises on botany is entitled *History of Plants*. It is composed of nine books and a fragment of the tenth. This work appeared about the year 314 B.C.; it was dedicated to Nicodorus, one of the Archons of Athens. Theophrastus enumerates about five hundred plants, which it is often very difficult to refer to the species now known. This is, however, a task which several learned commentators have taken on themselves, Scaliger and Bodee de Stapel among others, but without complete success. Kurt Sprengel has sometimes been more fortunate.

Theophrastus travelled only in Greece and Asia Minor; consequently, although he describes with sufficient care the plants of the countries which he passed through, and which, therefore, he had himself observed, he speaks with less accuracy of the plants of India, Ethiopia and Egypt, which are very few in number, and which he knew only through the description of merchants, travellers or naturalists, who had followed the expeditions of Alexander. He established only one very vague classification among the vegetables which he enumerated; nevertheless, he united them by certain analogies, such as their duration, consistence, their native place or their properties. He ranks in the same class shrubs and trees, that is to say, vegetables with ligneous fibre which last more than a century; and in another, those of soft and herbaceous consistence, and whose existence does not exceed two years. He examines, in separate chapters, aquatic, kitchen, parasitic, succulent, oleaginous, and cereal plants. He does not describe all that he names, but when he does so, he regards them in the various respects of their generation, size, and consistence, and this description is so complete as to leave nothing to be desired.

* In the year 371 B.C., about 14 years after Aristotle. This was the year of the battle of Leuctra.

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He is sometimes too credulous as to their medical properties, but it must be said that in writing rather as a botanist than as a physician, he attached little importance to this last consideration. In the ninth book, he speaks of juices, resins, tears, balsams, perfumes, of some very active medicines, and of certain poisons extracted from vegetables. The fragment of the tenth book treats of medicinal roots. The history of plants is particularly remarkable for the number and variety of the ideas it contains; it is the first and most extensive bequest of antiquity on the study of the vegetable kingdom.

To be continued.

RESEARCHES ON CURARE.*

BY MM. PELOUZE AND CL. BERNARD.

CURARE is a violent poison prepared by some of the natives, chiefly cannibals, who inhabit the forests in the vicinity of the High Oronoko, Rio Negro and Amazon.

Although this poison has been long known, we have as yet no precise knowledge as to the nature of its active principle. Even amongst the savages who sell or exchange it, its preparation remains a secret confined wholly to the priests or conjurors.

According to M. de Humboldt, curare is the aqueous extract of a weed belonging to the family of *strychnaceæ*; according to MM. Boussingault and Roulin, curare contains a substance analogous to the vegetable alkalis, *curarine*. The accounts transmitted to us by M. Goudot coincide with those of M. Humboldt so far as regards its being the aqueous extract of a sort of creeper; only he adds, that before the extract is quite dry, the Indians of Messaya drop into it some of the poison from the vesicles of the most venomous serpents. This last circumstance is of importance, as the physiological effects of curare lead us to regard its mode of action as analogous to that of the animal poisons.

Curare is a solid substance, black, of a resinous appearance, and soluble in water.

We will hereafter return to the chemical characters of this substance; first showing its physiological properties, as proved on living animals.

Curare resembles the venom of the viper in this well known particular, it can be introduced with impunity into the digestive canal of man or animals, whilst, if introduced by a puncture under the skin, in any part of the body, its absorption is infallibly and rapidly mortal. We have assured ourselves of the exactness of this statement by many experiments.

The poisonous action of curare is instantaneous when injected directly into the blood vessels. A weak aqueous solution of this poison put into the jugular vein of a dog or rabbit has always caused sudden death, without the animal uttering any cry, or manifesting any convulsive agitation. When curare in solution or in solid pieces is introduced under the skin, its fatal action is more slowly manifested, and the time varies a little according to the quality of the poison, the quantity introduced, the size of the animal and its kind. *Ceteris paribus*, birds die first, then the mammifera, and finally reptiles; but death is certain, with similar and very singular symptoms. The animal does not immediately give any apparent sign of anything being the matter. If a bird, for example, it flies as usual, but after some seconds, when the curare is very active, the animal falls dead, without uttering any cry and without any appearance of suffering. Neither do dogs or rabbits exhibit anything unusual immediately after the poison is deposited under the skin, but after a few moments, they lie down as if fatigued, and appear to fall asleep, then respiration ceases, sensibility and life disappear without the animal having uttered a cry or manifested any pain. There are sometimes perceptible slight muscular contractions of the face and body.

On opening the body of the poisoned animal immediately after death, we have always remarked phenomena which indicate a complete annihilation of all the properties of the nervous system. Generally, when animals have died suddenly, the nerves preserve for some time the power of reacting under the influence of mechanical or chemical excitants. If we excite a nerve of motion, we see convulsions of the muscles to which it leads; if we pinch the skin, we give rise to the peculiar movements designated *reflex movements*. After death by curare, none of these properties continue. When the animal is but just dead and is still warm, the nerves are as inert as those of an animal which has been long dead.

Finally, after poisoning in this manner, the blood is always black, and often so much altered as to coagulate with difficulty, and does not become red on contact with the air.

If we compare this action of curare with that of the venom of the viper, we shall find great analogy in its effects, except in intensity, with the phenomena observed by Fontana in the blood and nervous system of animals killed by the venom of the viper.

* *Repertoire de Pharmacie*, Nov., 1850.

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We have also remarked that curare, like the serpent's venom, may be introduced with impunity into the intestinal canal. This last peculiarity is the object of our present attention.

When we observe the perfect innocuousness of curare when introduced into the stomach, we might imagine that this poison must be modified, digested, in a word, by the gastric juices, in such a manner that its deleterious properties are destroyed. It was with the view of verifying this supposition that we placed in the sand-bath, between 100° and 104° F., for 24 or 48 hours, some curare in the gastric juice of a dog. After the lapse of this time, we pricked animals with this gastric juice containing curare in solution; these animals died in the usual manner: thus we proved that the contact of curare with the gastric juice for 24 or 48 hours does not alter its deleterious properties. This experiment has been often repeated, and varied in all ways, it has been produced sometimes out of the animal, and sometimes on the living animal itself. In the case of a dog in which we had caused a fistula in the stomach, we made him swallow some pieces of curare with or without his food, and when, after some time, we removed from him some of the gastric juice, we found that it had all the destructive properties of a solution of curare. We had thus before us the singular spectacle of a dog who carried in his stomach, without suffering any inconvenience from it, a liquid which causes instantaneous death to all the animals inoculated with it. Not only is the dog whose stomach contains curare free from danger to its existence, but his digestion remains perfectly unimpaired. We have several times distinctly proved that the gastric juice to which curare has been added loses none of its digestive properties.

It is, then, proved that the special action of the gastric juice cannot be the reason of the innocuousness of the curare when introduced into the stomach. The other intestinal liquids, the saliva, the bile, the pancreatic juice, furnish a similar result, that is to say, that none of these fluids destroy, by contact, the poisonous action of curare.

The explanation of the facts which we have mentioned will be easily given by demonstrating that there exists no power in the surface of the gastro-intestinal mucous membrane of absorbing the venomous substance.

We have stated that by a peculiar privilege the mucous membrane of the stomach and intestines does not permit of the passage through it of the poisonous principle of curare, although it is soluble. This fact is proved by the following experiment:—If we take the gastric mucous membrane fresh from a newly-killed animal (dog or rabbit) and adapt it to an endosmometer, in such a manner that the mucous surface is turned outwards; then plunge the endosmometer containing sugar and water into an aqueous solution of curare, we shall find, at the end of two or three hours, that the endosmose will be effected; the level will have risen in the endosmometric tube, nevertheless the liquid contained in it will present no trace of poison, as is proved if we inoculate animals with it.

If we let the experiment go farther, the endosmose of the poison might take place, but we should find at the same time that the membrane is modified, and that the mucus as well as the epithelium which cover its surface are altered, and have consequently permitted the imbibition or endosmose of the poisonous principle of the curare. This is so true, that if, instead of employing in this experiment sound and fresh membrane, we take one which is already decomposing, the endosmose of the poisonous liquid immediately takes place. We can also prove this same property of the intestinal mucous membrane in a living animal, and we arrive at this conclusion, that among the apparently perfectly soluble substances, some may be deposited in the surface of the gastro-intestinal mucous membrane, and remain there unabsorbed, and consequently without manifesting their action upon the organism. Now the active principle of the curare is precisely one of these.

As it would be useful to discover whether any other mucous membrane than those of the digestive organs possesses this same property with regard to curare, we have successively experimented upon the mucous membranes of the bladder, nose and eyes, and always found the same property of resistance to the absorption of the toxical principle of the curare. An injection of this poison into the bladder of a dog has been retained by the animal for 6 or 8 hours, without producing any ill effects; but the urine which it passed after that time had all the poisonous properties of curare.

One mucous membrane of the body made, in this respect, a very remarkable exception, this is the mucous membrane of the lungs: it behaves with respect to the absorption of curare exactly like the sub-cutaneous cellular tissue, that is to say, that where some drops of the toxical solution are introduced with all the necessary precautions into the air passages, death follows with the same rapidity as if we pricked the animal under the skin.

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We thus see that this mucous membrane, being designed solely for the passage of air to accomplish the phenomena of respiration, possesses a peculiar texture, and is without the mucus which lubricates the other surfaces communicating with the exterior. This circumstance accords perfectly with the observations already made by M. Magendie, upon the structure and properties of the bronchial mucous membrane.

We shall not further extend our remarks upon the different remarkable absorbing powers presented to us by the various mucous membranes of the body. We shall hereafter return to this subject, and show that the non-absorption of the active principle of curare is not an isolated fact; and that in the intestines, for example, many principles secreted in the digestive liquids, however soluble, are not absorbed, and are forced consequently to act as though confined in close vessels.

For the present, we arrive at these conclusions:—

1st. That curare acts upon animals in the same manner as venoms.

2nd. That its harmlessness, when introduced into the intestinal canal cannot be explained by the alteration or digestion undergone by the poisonous principle, but is a consequence of a peculiar property in the gastro-intestinal mucous membrane, which will not absorb it.

NEW THERAPEUTICAL AGENT—SOLUTION OF PHOSPHATE OF QUININE AND IRON.*

BY DR. CATTELL, OF BRAUNSTON, NORTHAMPTONSHIRE.

I HAVE much pleasure in directing the attention of the profession to the therapeutical employment of a compound, formed by phosphoric acid, pure quina, and hydrated peroxide of iron—solution of phosphate of quinine and iron. It was devised by me during the past year, and from an extensive trial of it, since that time, I am enabled to recommend it as a remedy likely to prove highly serviceable in those cases indicating the use of such a combination.

As much uncertainty exists respecting the chemical relations of phosphoric acid, and the different bases, it is unnecessary to observe, that it is to the therapeutical and not the chemical value of this compound that I attach importance.

I shall avail myself of the earliest opportunity of making further observations on the subject.

* *Lancet.*

IODIDE OF STARCH.*

BY M. BONNEWYN.

COMMENCE by heating in any vessel, 30 grammes of starch in a sufficient quantity of distilled water; gradually add 1 gramme 20 centigrammes of iodide dissolved in 20 grammes of alcohol; and, keeping it constantly stirred, the liquor changes its color immediately, and precipitates iodide of starch, which is of a beautiful blue color; collect it on a filter, leave it to dry, and preserve it in a similar manner to other iodides—in a sealed bottle.

AMMONIA-ACETAS FERRI AND SYRUPUS FERRI ACETATIS.†

BY A. G. ROPER, ESQ.

I HAVE for some time used the above preparations of iron in my practice, and as I have found them to be very efficacious in cases where iron was required, I beg to lay the formulæ for their prepartion before your readers. The syrup I consider to be well adapted for children; to adults I usually give them in combination.

AMMONIO ACETAS FERRI.

Dissolve one drachm of iron wire in half an ounce of hydrochloric acid, mixed with an equal quantity of water (by measure); then add half a gallon of water, and precipitate with five ounces of liquor potassæ; set aside for twenty-four hours; draw off the supernatant liquor with a syphon; fill again with water, and repeat the process a third time. Lastly, collect the precipitate on a linen filter; dissolve the oxide thus prepared in two ounces of strong acetic acid, and make up the measure to ten ounces with distilled water; set aside for twenty-four hours, and filter. To every twenty ounces of the filtered liquor add half a drachm of strong liquor ammoniæ. Dose, ten minims to half a drachm.

SYRUPUS FERRI ACETATIS.

Dissolve two pounds of sugar in ten ounces of water, in a water-bath; to the syrup, whilst hot, add eleven ounces of the acetate of iron, prepared as above (without the ammonia): when cold, filter through paper. Dose, twenty minims to one drachm.

A NEW REMEDY FOR SHORT-SIGHTEDNESS.

BY A. TURNBULL, M.D.

ADDRESSING the editor of THE LANCET, Dr. Turnbull says—I beg to call your at-

* *Journal de Pharmacie d'Anvers.*
† *Lancet.*

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tention to a newly-discovered remedy in cases of short-sightedness, which I have applied with very considerable success.

A few months ago, I observed that persons who are short-sighted, when looking at objects at a distance, partially close their eyelids, for the purpose of overcoming the difficulty they find in discerning them. This action is instinctive; it is a natural effort to adjust the eye to an increased sphere of vision. It is well known that short-sightedness depends not only on convexity of the cornea, but also on convexity of the lens; and having no hope of being able to effect any alteration in the structure of the lens, my attention was directed to the iris, which I found to be, in such persons, generally much dilated. It then occurred to me that contraction of the iris has the effect of apparently lengthening the convexity of the cornea, which approaches a circumscribed plane, that permits the rays of light to enter only in a straight line. The effect of this is obvious. The length of vision hereby necessarily becomes increased, and distant objects are brought within its range. It therefore struck me, that if we could discover any substance which could be so applied as to contract the iris, one cause of the defect of short-sightedness would be remedied. The result, I am happy to say, has been most satisfactory. In the first instance, I applied the extract of ginger, which was rubbed for five or ten minutes over the whole forehead, with the view of acting upon the branches of the fifth pair of nerves. Afterwards, I substituted a concentrated tincture of ginger, of the strength of one part of ginger to two parts of spirit of wine, decolorised by animal charcoal. The success of this application was remarkable. In many cases it had the effect of doubling the length of the vision. In some persons I found the iris was not much dilated, but very torpid. In these cases I applied the concentrated tincture of pepper, made of the same strength, and in the same manner as the tincture of ginger. This I used until I observed that the iris had obtained a greater power of contraction and dilatation, after which I had again recourse to the tincture of ginger.

This plan of treatment has been attended with the most signal success, and persons who were extremely short-sighted have very soon been enabled to lay permanently aside their concave glasses. The best method, I may observe, of testing the improvement of the sight during this treatment is not by taking a printed book, and holding it near, and then at a greater distance from the eyes; this range of vision is much too limited. It is better to fix the attention of the patient upon a distant object, such as the brass key-hole of a door, and by his stepping some paces backwards, so as to place himself at a greater distance from it, he will soon discover the progress he is making.

So important a discovery as this will, I hope, be fairly tested by the members of our profession, who may rely on the success of the treatment I have recommended, if it be only judiciously and carefully carried out. It is possible that the advantage derived from the tincture, as above described, may be ascribed to the alkaloïd principle of piperin which is held in solution in the tincture of pepper.

SOLIDIFICATION OF BROWN COD-LIVER OIL BY CARBONATE OF MAGNESIA.*

BY M. L. DELAHAYE.

THE repugnance of almost all patients to cod-liver oil has caused many means of administering it to be sought for—syrups, emulsions, gelatinous capsules, &c.: all these are good, it is true; but the small quantities of oil given by these means is often the cause of our being unable to have recourse to them.

From the results of my researches, I think I have found a good method of administering this oil in sufficient doses, and without exciting any repugnance in the patients.

Subcarbonate of magnesia.. 10 grms.
Cod-liver oil (brown)..... 50 ,,

Mix. After ten or twelve hours, the mixture is of a good consistence, and can be easily administered in unleavened bread.

It is a remarkable fact, that the same quantities of calcined magnesia, used to solidify copaiba, do not give any consistence to cod-liver oil, even after a longer time than is required to solidify copaiba.

But it should be stated that the white cod-liver oil has for some time been sold, and will not solidify with magnesia like the brown. To what, then, is to be attributed the solidification of the brown oil and the non-solidification of the white? I leave the solution of this problem to men more versed in science than myself, only giving my opinion: I think that brown cod-liver oil, being more fraught with iodic products than the white, it may be that the solidification is attributable to these products. I also think it would be well to use white cod-liver oil only when we have accurate

* *Repertoire de Pharmacie*, Oct., 1850.

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data as to its properties; for it is not always in the beauty of a medicine that its quality consists.

The observations which I have here addressed to you upon white and brown cod-liver oils, have led me to examine whether other oils are susceptible of solidification with magnesia.

Having employed the same quantities, I have remarked that castor oil, clove oil, linseed oil, sweet almonds, oil of Colza, do not any of them solidify with magnesia; walnut oil is the only one that becomes slightly consistent with it, but much less so than brown cod-liver oil.

Note.—The remarks of M. Delahaye are very interesting. I own that, without adopting his hypothesis as to the cause of the solidification of brown cod-liver oil, I should distrust those colorless oils which would not solidify with white magnesia, if this character is as general as his experiments seem to indicate.

GUTTA PERCHA PLASTER.*

BY M. VERBUCKEN.

℞ Emplastrum diapalmæ .... 6 parts.
Gutta percha..... 4 ,,
Calamine powder ..... 6 ,,

The gutta percha is softened in hot water, and the *emplastrum diapalmæ* melted in a basin; the calamine and the gutta percha are then incorporated over a moderate fire, by means of an iron pestle previously heated; when the mass is well mixed and homogeneous, it is spread on a moistened board, and, by means of a ruler, reduced to the thickness required. When, in consequence of the length of the operation, the mass becomes cool, it is dipped into hot water, and the operation concluded by means of a ruler.

PROCESSES OF PREPARING CHLOROFORM.†

MEURER'S PROCESS.

CHLORIDE of lime, 5 kilogrammes; water, 15 kilogrammes; alcohol, at eighty per cent., 500 grammes. The chloroform is mixed with a sufficient quantity of milk of lime to remove all traces of chlorine, and then rectified. From 150 to 180 grammes of pure chloroform are thus obtained. If a stronger alcohol or a larger proportion be employed, the product is less. Four distillations made with the above proportions, but varying the quantity of chloride of lime employed, yielded—1. 153·50 gram.; 2. 112·00 gram.; 3. 116·00 gram.; 4. 112·00 gram.

CARL'S PROCESS.

Chloride of lime, 5 kilogrammes; water, 9 kilogrammes; alcohol, 84 per cent., 1200 grammes. Mix the whole in the still, and after standing about twelve hours, heat moderately, so as not to exceed 75° C,. (167° F.) In about three hours the chloroform passes over, and the distillation is finished in half an hour. The mean of 17 preparations, gave a product of 285 grammes.

M. SIEMMERLING'S PROCESS.

This process, which furnishes the largest proportion of chloroform compared with the alcohol employed, is as follows:—Chloride of lime, 8 parts; caustic lime, 1 part; alcohol, 1 part; water, 40 parts. M. Siemmerling has also experimented with acetone, but did not find the process advantageous, the product not being more than one-third that of the acetone employed:—Acetone, 30 grammes; chloride of lime, 150 grammes; water, 5 kilogrammes. Chloroform prepared with wood naphtha always contains a substance which is blackened on the addition of sulphuric acid; 50 grammes of wood spirit give 6 grammes of chloroform.

CHLOROFORM IN THE TREATMENT OF LEAD COLIC.

BY M. ARAN.

I AM of opinion that there are many circumstances in which old medicines, and, in particular, purgative medicines, may be advantageously combined with the treatment I propose.

In the first place, let me say a few words on the treatment to which I subject my patients. At the morning visit, if the pains seem rather sharp, I put upon the stomach, or the part occupied by the pain, a topical application of chloroform; for that purpose, I moisten a compress and squeeze it slightly; I then pour upon it from 4 to 8 grammes of chloroform, according to the space occupied by the pain and its intensity. The compress is applied to the skin by the hand of a nurse or of the patient himself for between a quarter and half an hour. In the course of the day, the patient takes the following mixture administered by spoonfuls:—

* *Journal de Pharmacie d'Anvers.*
† *Patent Journal*, November 23, 1850.

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Chloroform.....	40 drops
Gum tragacanth.....	4 gram.
Common syrup.....	30 ,,
Water.....	100 ,,

Besides this is administered in the afternoon a simple lavement to free the larger intestines, and immediately afterwards a fourth of the following lavement :—

Chloroform.....	20 drops.
Gum tragacanth.....	8 gram.
Yolk of egg.....	No. 1.
Water.....	125 gram.

The next day, if the pain be not entirely removed from the abdomen, which is very rare, a fresh topical application is made, and it seldom happens that we are obliged to have recourse to it a third time. The draught, the simple lavement and fourth part of the chloroform lavement are to be continued daily until the bowels act naturally and spontaneously.

In the mean time, the patient takes sulphurous baths and soapy alkali baths on alternate days, intended to free the skin from the lead which may be on its surface.

PREPARATION OF ATROPINE BY MEANS OF CHLOROFORM.*

BY M. BABOURDIN.

In a memoir published by MM. Bouchardat and Stuart Cooper, reported in the *Annuaire de Therapeutique* M. Bouchardat's for 1849, these chemists describe a process for the preparation of atropine by which they obtained it very pure, but in exceedingly small quantity. MM. Bouchardat and Stuart Cooper have preceded the description of their process by the following observations.

The preparation of atropine cannot be so easy as the authors who discovered this vegetable alkali imagined, for in France we know several chemists who have tried unsuccessfully to obtain it; that which is found in commerce being of German manufacture, etc.

The known means for the extraction of the active principle of the belladonna in a state of purity is so imperfect that, I have that a process which would permit of its being obtained in a simple, quick and easy manner would be very serviceable.

Take fresh balladonna (Atropa belladonna) when it begins to blossom, bruise it in a marble mortar and submit it to pressure to extract the juice, heat it to 190° F. to coagulate the albumen, and then filter it. When the juice, thus clarified, is cold, add to it 4 grammes of caustic potassa and 30 grammes of chloroform per quart, shake it for a minute, and then leave it to repose. At the end of half an hour, the chloroform, charged with atropine, is deposited, having the aspect of a greenish oil, then decant the superfluous liquid, replace it with a little water; this is afterwards decanted and washing continued until the water is clear. The chloroform solution is then placed in a small retort; distil it in the sand bath until all the chloroform is passed into the receiver. The residue of the retort is redissolved in a little water acidulated with sulphuric acid, which dissolves the atropine, leaving a green resinoid matter; the filtered solution is colorless. To obtain the atropine in a state of purity it is sufficient to pour into the solution a slight excess of carbonate of potassa, to collect the precipitate and dissolve it in rectified alcohol. This solution gives by spontaneous evaporation, beautiful groups of needle-shaped crystals of atropine.

In default of the fresh plant, well prepared officinal extract may be used; dissolve 30 grammes of extract of belladonna obtained from the purified juice of this plant in 100 grammes of distilled water; to the filtered solution add 2 grammes of caustic potassa and 15 grammes of chloroform. After having agitated the liquor for a minute, leave it to repose for half an hour; the chloroform charged with atropine is then deposited, the supernatant liquid is decanted and replaced by water, which is thrice renewed, the chloroform solution, collected on a watch glass, weighed 11 grammes, (4 grammes of chloroform being lost during the manipulation). This solution, left in the open air, rapidly evaporates, leaving a greenish crystalline mass, formed almost entirely of atropine; dissolved in water acidulated by sulphuric acid, this mass again precipitated by a solution of carbonate of potassa, gives a precipitate which, when collected, weighs 16 centigrammes. It is entirely soluble in rectified alcohol, and furnishes by spontaneous evaporation beautiful needles of atropine.

I think this mode of treating bell adonna capable of general use, and applicable to many other substances containing organic alkalis, if it does not become the means of the preparation of these products, at least it will aid in some cases in the prompt estimation of the richness of certain commercial products.

In a future communication I will describe the method of promptly and commercially estimating the alkaloïds of the cinchonas by acting on a very small quantity of bark.

I shall also prove that by means of

* *Repertoire de Pharmacie*. Nov. 1850.

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chloroform, traces of iodine may be detected, and show the advantages presented by this method, over testing by starch.

AMALGAM OF TIN AND CADMIUM FOR THE TEETH.*

BY M. VARRENTRAPP.

THE copper amalgam of the Paris dentists has the disadvantage of turning black after a short time. The following preparation may be conveniently substituted for it:—Tin, 2 parts; cadmium, 1 part. Melt together, and run into an ingot, which reduce to large filings to dissolve afterwards in mercury; this done, pass the fluid through a piece of leather, and work up the residue in the hand, by which means it soon assumes a consistence which permits of its being moulded into any form required. The last operation must, however, be performed quickly, for in about ten minutes it becomes brittle, and at the expiration of twenty-four hours, it becomes sufficiently hard to resist pressure.

THE MERCURIAL TREATMENT OF SYPHILITIC ERUPTIONS.†

MR. HUNT read a paper on the mercurial treatment of syphilitic eruptions, in which he contended for two important propositions. 1. That mercury was capable of either curing or aggravating all these diseases, according as it was administered. 2. That none of them would get permanently and radically well without mercury.

In reference to the first proposition, the author expressed his belief that mercury acted most favorably when its effect was sudden and intermittent, and that a continued course was liable to aggravate the disease. He believed the medicine would effect all its therapeutic benefits without irritating either the gums or the bowels, and he was accustomed to administer it in two or more succesive and increasingly energetic courses, until the disposition to disease was destroyed. In reference to the second proposition, viz., that none of these diseases, generally speaking, would get permanently and radically well without mercury, the author alleged that the apparent spontaneous recoveries were for the most part only temporary, and that the alterative or non-mercurial cures were equally unsound, and to be accounted for on the theory that, under favorable circumstances, the system was capable of tolerating the presence of an animal poison for a time, and sometimes even for life; but even in that case, the children of the patient were liable to become affected, and that, in fact, a very large proportion of cutaneous diseases now existing in England proved to be cases of heriditary syphilis, originally treated, in the parent, without mercury.

Dr. Winslow inquired what was the precise nature of the shock which mercury was supposed to give to the system, and also what changes were effected by it in the organic nerves. He was also anxious to ascertain by what symptoms we could detect during life the existence of latent syphilis.

Mr. Dendy wished Mr. Hunt to describe the appearances presented by the syphilitic eruptions. Biett had led the profession into error by speaking of them as always copper colored.

Mr. Hancock was desirous to know what guides the profession might trust to respecting the courses of mercury, when it should cease, and when it should be recommenced.

The President recommended Mr. Hunt to reply to all questions, &c., at the close of the debate.

Dr. Daniels objected to the universal exhibition of mercury, for, although it was undoubtedly of service in the majority of cases, yet instances occurred in which it would prove injurious. He did not doubt that syphilis might be transmitted from parent to offspring, but he had also seen cases in which appearances resembling that disease had been discerned in the child, without any cause of suspicion in the parent; and he instanced the case of a person who died while under salivation for liver disease, in whose offspring pseudo-syphilitic signs were detected, without any indication of syphilis in the parent.

Dr. Crisp was of opinion that mercury would ultimately prove the most beneficial, but he thought that Mr. Hunt had not distinguished the primary sores sufficiently, and would wish to know if he would use mercury in all cases.

Mr. Hunt in his paper had alluded to secondary disease alone.

Dr. Crisp explained the transmission of disease from an apparently uninfected female to her male friend, alluded to by Mr. Hunt, by the possibility of infecting matter having been left in her genitals by a previous acquaintance. He remarked that pseudo-syphilis was not produced by mercury in the workers in quicksilver; while the natives of Africa, not using appropriate remedies for the disease were very liable to disease of the

* *Patent Journal.*

† Report of Medical Society of London, 16th November, 1850.

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bones. In no cases were the effects of mercury so evident as in the treatment of secondary symptoms in children.

Mr. B. Travers related a case of secondary symptoms in a married female, lately under his care, in whom, after the internal exhibition of mercury, twice pushed to salivation, and the use of the hydriodate of potassa, had caused no other result than exasperating the local symptoms, and breaking down the health; inunction effected a cure. The patient had sores and an eruption on the back of the neck, rupial crusts on the vertex, sore throat, a sore on the leg, and a discharge. The disease was of a year's duration, and was communicated by the husband, who had never had other than gonorrhea and gonorrheal sores. The treatment consisted in inunction; 3j. of the ung. hyd. f. being rubbed in every night, with bark and sulphuric acid, and a good nutritious diet. The rupial crusts were dressed with the ung. hyd. nit., and a gargle of muriate of ammonia was ordered for the throat. In eight weeks she was quite well. The inunction caused some degree of salivation. Mr. Travers had often seen inunction cure the disease, when salivation, by the internal use of mercury, had repeatedly failed.

Mr. Dampier had often found a primary sore in the urethra, in those cases of secondary disease where the patients denied its having occurred, and where there was not any external evidence thereof.

Mr. Robarts remarked, that Mr. Hunt had overlooked one of the causes of failure, when mercury was given. It is sure to fail in anæmic persons, unless its use be preceded by, or accompanied with steel, and also in plethoric individuals unless saline purgatives and warm-baths constitute part of the treatment. The disease is both local and constitutional, and should be so treated. When mercury fails to exert its due effect, it is in consequence of some latent error in the system.

Dr. Golding Bird considered, that in no case was the use of mercury so satisfactory, as in secondary syphilis in children; but, as there were also, at all events in hospital practice, cacoœmia and anæmia to combat, the mercury should be followed up by iron, so as to build up the blood and restore the strength; otherwise, in the course of a year or two, another form of disease, condylomatous sores, would appear. In anæmic cases he generally gave one grain of hyd. c. cretâ, with three or four of the brown sesquioxide of iron twice a day. The red sesquioxide is utterly valueless.

Mr. Dendy thought Dr. Golding Bird, Dr. Crisp, and Mr. Hunt were led into error in their cases by supposing that all copper-colored eruptions were syphilitic, which was not the case, especially in children. Neither did the success of the treatment by hyd. c. cretâ prove their venereal origin, as other diseases than syphilis may be cured by mercury. He approved of Mr. Hunt's mode of giving mercury, and also of the use of tonics, both after and with mercury. He employed the syrup of the iodide of iron. He could not admit that mercury would not produce disease. He had always looked upon it as an intense poison, which cured syphilis by exciting a poisonous action, which would wear out, while that of the disease would not.

Dr. Golding Bird had said, respecting his cases, that the children had secondary syphilitic eruptions. He had not used the term "copper-colored." In the majority of cases the mothers were under treatment for syphilis at the same time. Tonics, as such, were not useful; they must be hæmatogenic, or blood-generating, such as steel.

Mr. Nunn inquired of Mr. Hunt, who had stated that mercury acted on the organic nerves, how it was that it cured syphilis, which is a blood disease.

Mr. Hunt, in reply, observed, that the facts mentioned by the different speakers fully supported all his opinions. Mr. Travers' case was one of great interest, and he had frequently met with such. As regarded the signs of latency, the absolute fact that the disease was latent, rendered it impossible to detail them. A sufficient number of courses of mercury could alone, he believed, destroy the latency. He applied the term "syphilis" to that disease in which all the characters are present, and in their ordinary order. Every copper-colored eruption is certainly not venereal, neither is every syphilitic eruption of a copper color. Color is no test of the disease. He urged the necessity of watching the effects of mercury more closely than had been practised, and coincided with Mr. Robarts and Dr. Golding Bird in the opinion, that in anæmic cases it was well to combine mercury with iron; and, in plethoric subjects, with evacuants and a reduced diet.

NOTICE.—*All Communications, Books for Review and Substance for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON THE ESTIMATION OF IODINE IN ORGANIC SUBSTANCES BY MEANS OF CHLOROFORM.*

BY M. RABOURDIN.

THE method of seeking iodine by means of starch paste leaves nothing to be desired in the way of sensibility, but it is not the same when we wish to appreciate the quantity of iodine contained in organic substances.

I would propose chloroform, not as an exact test of the iodine in these substances, but to arrive at a very satisfactory approximation. Chloroform may besides be very advantageously used with starch to detect traces of iodine, for, with the assistance of this agent, it may be discovered in a liquid containing less than one hundred-thousandth of its weight.

If 10 grammes of a liquid containing $\frac{1}{100000}$ of its weight of iodide of potassium are taken, and 2 drops of nitric acid, 15 or 20 drops of sulphuric acid and 1 gramme of chloroform be added, the chloroform will, when it is shaken, take a very distinct violet tinge.

I have availed myself of the remarkable property possessed by chloroform of removing the free iodine from water, and of acquiring a violet color, as a means of approximatively testing the iodine in organic substances, especially in cod-liver oil, now so much used in medicine.

I take 50 grammes of cod-liver oil, which I mix, by agitation in a phial, with 5 grammes of caustic potassa, dissolved in 15 grammes of distilled water, and I heat this mixture in a large iron spoon until the organic matter is destroyed; the charcoal produced by this combustion is washed with distilled water, to remove all the soluble portions: as little water as possible must be used. The liquid proceeding from the washing is filtered, 10 drops of nitric acid and of concentrated sulphuric acid are added, taking care to cool it; 4 grammes of chloroform are added, and the whole shaken quickly. By standing, the chloroform is deposited of a violet color; the supernatant liquor may be decanted, and the chloroformic solution washed with water, without causing any loss of color.

On the other hand, prepare a test liquor containing 1 centigramme of iodide of potassium in 100 grammes of distilled water, so that 10 grammes represent 1 milligramme of iodide.

Take 10 grammes of this solution, add two or three drops of nitric acid, twenty drops of sulphuric acid, and 4 grammes of chloroform; agitation produces a coloration comparable to the shade given by cod-liver oil; it is usually necessary to add 1, 2 or 3 grammes of the test liquor to obtain a tinge of equal intensity.

I have tested three principal kinds of cod-liver oil found in commerce.

No. 1. Deep mahogany color, called brown in commerce;

No. 2. Amber color, called light in commerce;

No. 3. Scarcely colored, called white or English in commerce.

Each kind was tested three times, operating, as above mentioned, on 50 grammes.

To obtain a color equal in intensity to that given by 50 grammes of mahogany colored oil, I used 14 grammes of test liquor,

* *Comptes Rendus*, 2nd Dec., 1850.

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equal to 0·0014 gr. of iodide of potassium, and 12 grammes only of the same liquor for the two other species of oil.

These three kinds of oil contain, then, clearly the same proportion of iodine, which would be 1 milligramme to 50 grammes, if there is no loss during the combustion.

I have besides proved by experiment that chloroform removes all the free iodine from an aqueous solution of that body. I saturated 500 grammes of water with pure iodine, I agitated it three different times, with 15 grammes of chloroform each time. The third time the chloroform was scarcely colored.

I may here introduce a remark which I have made, and which may be useful, namely, that pure chloroform by dissolving a small quantity of iodine takes a very beautiful violet color, comparable in every respect to the color of the vapor of iodine; but if the chloroform is mixed with sulphuric ether, in however small a proportion, instead of a violet color we have only a wine-like color, and even a caramel-red color, if the ether is to an appreciable amount: this fact will aid in discovering the adulteration of chloroform with ether.

ON THE EXPLOSIVENESS OF NITRE WITH A VIEW TO ELUCIDATE ITS AGENCY IN THE TREMENDOUS EXPLOSION OF JULY 1845, IN NEW YORK.*

BY ROBERT HARE, M.D., EMERITUS PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF PENNSYLVANIA, AND ASSOCIATE OF THE SMITHSONIAN INSTITUTION.

(Concluded from page 152.)

16. If I am right in supposing that in fulminating power the intensely heated nitre and the combustible merchandise were for equal weights equivalent to gunpowder, if only a sixth of the 300,000 pounds of nitre held in the store was engaged in the final explosion, it would be equivalent to 60,000 pounds of gunpowder.

17. No better way of estimating the force with which the nitre and combustibles were brought into collision for the last time, at which the finishing explosion took place, has occurred, than that of comparing it with the blow by which nitre and sugar were exploded, as above mentioned, in one of my experiments.

The weight of the combustible matter contained within the store was 700,000 pounds. The store was 90 feet deep by 24 wide. Supposing the horizontal area of the sledge, as applied, to have been $3 \times 3 = 9$ square inches, it seems that for every equivalent horizontal area within the store, there must have been twenty-two pounds, or about three times the weight of the sledge. Hence, in descending from a height of 20 or 30 feet, which there was ample room for it to reach, the combustible congeries may have attained a much greater velocity than could be imparted to the sledge, and may consequently have produced a much more forcible impact. At the same time, this must have caused an intimate penetration and intensity of compression, which by a dead weight it is almost impossible to create.

This explanation, so far as it rests upon the assumption that the combustibles were made to dance upon the surface of the melted nitre, is supported by the fact, that any combustible mass, when thrown upon the surface of incandescent nitre, will undergo a dancing motion, so as sometimes to leap out of a deep pot within which the experiment may be made.

18. The phenomena are not irreconcilable with the idea that some of the earlier explosions arose from the falling of the liquid nitre upon the combustibles before all the floors gave way; but it should be recollected that nitre fuses at a low red heat, and at a cherry-red gives out oxygen gas. The presence of this gas, as well as the deflagration resulting from contact with the liquid nitre, must have caused the floors to be oxidised with a rapidity far exceeding that which takes place during ordinary conflagrations.* To the causes of quick destruction thus suggested, must be added the mechanical force of the explosions directly at war with the persistence of the floors. That, prior to the last explosion, the nitre must have been collected in the cellar, may be assumed from the fact, that the temperature being inevitably far above its fusing-point, the salt must have been all liquefied, and occupying the lowest accessible cavity, on account of its superior specific gravity. This assumption is moreover justified by the circumstance that the force of the explosion appears to have been especially exerted upon the parieties of the cellar, the walls and surrounding earth having given way in a manner which created astonishment.

19. In order to amplify the practical basis upon which the preceding inferences

* Presented by the Author to the Smithsonian Institution.

* See Note to paragraph 9, pages 149, 150.

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had been founded, I made some experiments on the combustion of gunpowder in an exhausted receiver, so as to secure the gaseous products evolved. A cylindrical glass receiver, such as is usually employed as a candle-shade, was ground upon a lap-wheel, so as to fit air-tight between two discs of sheet brass. The disc for closing the upper opening of the receiver was furnished with two cocks severally, for communicating with an air-pump and barometer guage. The disc for closing the lower opening of the receiver, so as to form the bottom of the space included, was furnished with an arch of platinum wire soldered to two stouter brass wires, of which one was soldered to the disc, the other secured and insulated in passing through it by a collet of leather, compressed about it by an appropriate screw. These preparations being made, a portion of gunpowder, weighing about twenty-five grains, was so supported on a tray, as to include the middle portion of the platinum wire. The receiver being put into its place, so as to be duly supported by the lower disc and covered by the other, the air was withdrawn, as far as practicable, with a good air-pump. In the next place, the wire was ignited to incandescence. To my surprise, the gunpowder only smoked at first, and did not flash until a perceptible interval had elapsed. When this result ceased, it appeared to be owing to the radiant heat, as the early volatilisation of a portion of sulphur had driven the granules away from the wire, so that it did not touch any of them. Subsequently, on allowing the air to enter, and removing the receiver, it appeared that the gunpowder was only partially burned. Thus it became evident that in this way a complete combustion could not be effected. The feebleness of the flash *in vacuo* shows how much confinement is essential to give energy to the explosion of this powerful agent; and its not being forthwith ignited by an incandescent wire, demonstrates that, as in the case of the apparent quiescence of a globule of volatile matter in an intensely heated cavity, a capability of volatilisation delays this process, by preventing the contiguity requisite to a communication of heat.

20. This leads to a discrimination which has not, to the best of my knowledge, been made heretofore. I allude to the difference existing between fulminating *combinations* and fulminating *mixtures*. As an example of the latter, we have gunpowder and other pulverulent mixtures consisting partially of nitre, or chlorate of potassa, while as an exemplification of the former, we may advert to aurum or argentum fulminans, or to the fulminates of mercury or silver; also to the chloride or iodide of nitrogen, or perchloric ether. Compounds of the last-mentioned kind, without confinement, break the vessel on which they are exploded. They cannot be used in gunnery, because the force in their immediate vicinity, in proportion to its durability, is too great, so that they burst the chamber before the ball moves an available distance. The elements in these combinations are in a state of intense chemical union, and can only leave that state for another, by which gases and vapors are produced with an instantaneous and almost irresistible expansibility. They require no confinement, because already confined by their reciprocal affinities. In gunpowder and analogous mixtures, the ingredients exist without any forcible coherence, so that an incipient reaction causes a tendency to move apart, which prevents the reaction from extending itself when there is no confinement. This was strikingly shown by attempting to burn *in vacuo* a small cylinder of consolidated gunpowder, made by intense pressure within a metallic tube by a steel piston. This cylinder, about a half-inch in diameter and an inch in length, was placed in contact with a platinum wire within an exhausted receiver. The wire being ignited, a feeble combustion ensued. Subsequent examination showed that the cylinder was only about half deflagrated, the unburnt portion remaining unchanged. It had been extinguished spontaneously, after being completely ignited at the end in contact with the incandescent wire.

21. This was, no doubt, in consequence of the process being effected in a rarefied medium. In order to compare these observations with those which might be made by combustion *in pleno*, I made a larger cylinder of gunpowder, 2 inches in diameter and 2 inches in height, by similar means, and set fire to it by an iron rod ignited at one end. This I caused to touch the top of the cylinder while standing upright at the bottom of a cast-iron pot about 4 inches in diameter and a foot in depth. The combustion very much resembled that of a rocket, commencing feebly, however, yet terminating with a deflagration so rapid as to be almost explosive. The augmentation of intensity I ascribe to the increased resistance from reaction with the gas evolved, which pressed upon the cylinder with a force like that which elevates a rocket.

22. Finding that, *in vacuo*, a perfect combustion could not be accomplished by the means above mentioned, I resorted to an arrangement through which a cylinder of

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consolidated gunpowder might be so supported by a rod sliding in a stuffing-box as to be pushed upwards against a wire ignited by a galvanic battery within an exhausted receiver. When, by these means, the ignition of gunpowder was attempted, it was not very readily accomplished. The part touching the wire appeared to burn feebly; nevertheless, by turning the rod so as to cause the cylinder to revolve, and consequently to be assailed at various points, combustion was induced and gradually extended, and at last completed satisfactorily.

23. The receiver employed was held between two metallic plates, one forming the bottom, the other the cap. Through the middle of the bottom the sliding rod was introduced, so as to be in the axis of the cavity. It was secured by two stuffing-boxes, the object of the outer one being to enable the rod to pass through the orifice of a vessel of oil, employed to prevent the possibility of air entering through that next the cavity. The juncture of the cap with the receiver was covered by cold water, which served to prevent leakage, and keep down the temperature. This was ascertained by a thermometer within the receiver, yet accessible to inspection. The cavity, thus secured against leakage, held 240 cubic inches; the contents being indicated by a column of mercury in a barometer tube situated before a scale graduated into 480 parts. Of course, the whole contents being 240 cubic inches, as above stated, each graduation represented half a cubic inch.

24. The igniting wire was soldered to the ends of brass rods, of which one was soldered to the cap, the other secured by collets of leather, so as to pass through the cap without metallic contact. Consequently, connexion being made between this insulated rod and one pole of a battery, while the other pole had a metallic communication with the cap, the wire might at any moment be made the medium of a circuit competent for its intense ignition.

25. The upper end of the sliding rod supported a little disc of sheet copper, and a little below that disc was supported, in like manner, a larger disc of the same material perforated like a colander.

26. Upon the upper disc, the consolidated gunpowder being supported with all the above-mentioned arrangements, the receiver was replaced.

27. The air was withdrawn until the mercury in the guage-tube attained nearly the height of the column within an adjoining Torricellian tube, or that of a neighboring barometer. The height was recorded, likewise the temperature indicated by the thermometer. The fall of the barometrical column of mercury in the guage-tube, resulting from the operation, was not estimated until the mercury in the thermometer was *statu quo*. The difference in degrees caused in the height of the barometric column, divided by two, gave the number of cubic inches of gaseous matter evolved. This difference was of course set down.

28. In the next place, the temperature being carefully observed and recorded, about 2 cubic inches of a strong solution of caustic potassa were added. The consequent absorption, as it declined in rapidity, was assisted by an agitation consequent to moving up and down the rod, and the perforated disc attached to it. When no more absorption could be observed to take place, judging by the quiescence of the mercurial column in the guage, and when the temperature had returned to the starting-point from which it had been disturbed by the heat generated through the reaction between the alkali and carbonic acid, the height of the column was again recorded, and the difference of degrees, divided by two, was estimated to give the number of cubic inches of carbonic acid generated. Allowance was made for the mechanical effect of the bulk of the alkaline liquid in lowering the mercurial column founded on actual measurement of the effect of a like quantity of water; the mercury being brought to the same height in the guage-tube, in an experiment made for the purpose with atmospheric air.

29. Three samples of Dupont's powder were obtained from the United States Arsenal, severally designated cannon, musket, and rifle powder. Of each, 75 grains were pressed into an indurated cylindrical mass, as above described, and successively burned in the exhausted receiver.

The following are the results:—

		cubic in.
Cannon powder,	gas evolved.....	55
,,	,, absorbed....	23½
Musket powder	,, evolved.....	52
,,	,, absorbed....	21½
Rifle powder	,, evolved.....	51½
,,	,, absorbed....	20½

Sporting powder, average of two experiments—

Gas evolved..... 51 cubic in.
,, absorbed..... 25 ,,

30. As the gas left after the removal of the carbonic acid had all the negative characteristics of nitrogen, it may be concluded from the results above given, that the gaseous products of deflagrated gunpowder consist of nearly equal volumes of carbonic acid and nitrogen.

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31. I was naturally led to compare the results of the deflagration of gun-cotton with those of gunpowder. Accordingly, I exposed a tuft of gun-cotton, weighing 25 grains, in the exhausted receiver in a similar way. I found a retardation in the activity of the combustion arising, as in the case of gunpowder, from the absence of mechanical confinement, diminution of atmospheric pressure tending to lessen the contiguity indispensible to intense chemical reaction.

32. The deflagration of the tuft being effected, it caused an evolution of gas equal to 19½ cubic inches.

33. In order to concentrate the combustible ingredients, resort was had to the apparatus employed in the case of gunpowder, by which means 25 grains of the cotton could be condensed into a cylinder of about half an inch in width, and of a like length.

34. Two specimens of gun-cotton, of the manufacture of Lenning, of 54 grains each, prepared and ignited as above described, gave an evolution equal to 126½ cubic inches.

35. As 75 grains of gunpowder gave only 55 cubic inches of gas at most, it appears that equal weights being employed, gun-cotton causes a gaseous evolution more than three times as great as gunpowder.

36. As 75 grains of gunpowder produce, taking the largest amount in the above table, only 55 cubic inches of gas, it follows, that to produce an effect equal to 54 grains of gun-cotton, 172½ grains of gunpowder would be requisite.

37. The gunpowder evolved little more than seven-tenths of a cubic inch per grain, while the gun cotton evolved more than two cubic inches per grain.

38. The gas arising from the gun-cotton did not admit of an examination so simple as that given out by gunpowder.

39. By the introduction of 100 cubic inches of oxygen gas, it appeared from the consequent red fumes, and absorption by water, that about 35 cubic inches of nitric oxide had been formed: by the introduction of caustic potassa, about 25 cubic inches of carbonic acid were indicated. One-third of the residual gas being exploded with oxygen, appeared to consist of three volumes of hydrogen to four of carbon vapor. The washings gave indications of cyanogen.

40. The coexistence of nitric oxide, carburetted hydrogen and cyanogen, in the products, justifies the idea, that were the heat greater, the expansive effect would be augmented by the transfer of the two atoms of oxygen in the oxide, to the hydrogen and carbon, producing augmentation of temperature, carbonic acid and aqueous vapor. In order to bring the explosive power of gun-cotton to its maximum, I infer that immense resistance would be necessary, thus concentrating and expediting the reaction.

41. The residue of the explosion of gunpowder appears, from a qualitative analysis, to consist of sulphocyanide and sulphide of potassium, with carbonate and sulphate of potassa. The two latter are by much the more abundant products. Probably sulphur is the primary and most energetic ingredient, as when in excess it is, *per se*, known to be capable of completely decomposing potassa at a moderate heat, while carbon can only partially effect an analogous change at the highest heat of a furnace. Faraday has recently alleged, that the production of the flame of sulphide of potassium is an important agent in the explosive ignition of gunpowder. It is likely that from the reaction of oxygen with sulphur and potassium, a temperature results sufficiently high for the combustion of the charcoal with oxygen, and of nitrogen with sulphur and carbon, whence ensues carbonic acid and sulphocyanogen, in union with potassium in the one case, and with potassa in the other.

42. I have already distinguished the explosion of mixtures like gunpowder from fulminating combinations, of which the constituents, being held together by intense chemical affinity, require no mechanical confinement nor impact to bring or keep them sufficiently near each other for reciprocal reaction. There is, however, another distinction to be made. The explosion of vessels by high steam is altogether the effect of heat and confinement. The resulting violence, when the vessel bursts, is directly as its strength; so that, knowing how many pounds per square inch the vessel was capable of bearing, we know the explosive force to have been exactly equal thereto. But the strength of the containing vessel, in the case of gunpowder, may be very far short of that generated by the gunpowder ignited within it. When held together until the temperature is attained which is requisite for the play of affinities into which the ingredients are disposed to enter, a sudden evolution of heat and gaseous matter takes place, producing a disruptive force far beyond the retaining power of the vessel.

43. Although gun-cotton is a chemical combination consisting of nitric acid and lignin, yet it does not explode, when unconfined, with a violence approaching to that of other fulminating combinations above mentioned. This may be attributed to the fact that neither the elements of nitric acid, nor

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those of lignin, are held together by a strong affinity, and consequently the forces which resist explosion are but feeble.

SUMMARY.

It is an old and well-accredited maxim in chemistry, to which there are but few exceptions, that fluidity is requisite to chemical reaction. The fluid state, of which the necessity is thus asserted, is with few exceptions attained only through water, or heat, or both. In truth, however, when it is considered that without heat there could be no fluidity, heat may be viewed as the sole solvent. As respects the induction of the state requisite to chemical reaction, we may consider the solution in which water is the ostensible agent, or igneous fusion in which it is absent, as the only means of bringing the atoms of solids into the state requisite for chemical reaction, through which decompositions and recompositions are effected.

It is well known that the affinities which prevail among the same set of bodies when liquefied by aqueous solution, may be the opposite of those which they exert when indebted to heat solely for liquefaction. Thus there is scarcely any acid which will not displace silicic or boric acid from alkaline bases when in aqueous solution; yet when salts, consisting in part of the most energetic acids, are fused with silicic or boric acid, decomposition ensues in consequence of the union of the acids last mentioned, with the bases ignited with them.

The sulphates, carbonates, or hydrates of potassa, soda, and of some other bases, are *per se* indecomposible at any heat at which their bases cannot be volatilised; yet the nitrates of the same bases are decomposed at the temperature of incandescence. It follows, that if a nitrate be exposed to igneous fusion with any substance consisting more or less of hydrogen, carbon, or sulphur, the oxygen of the nitrate will, by forming water with the hydrogen, carbonic acid with the carbon, or sulphuric acid with the sulphur, cause the nitrate to be replaced by a hydrate, a carbonate, or sulphate.*

But as in every atom of nitrate there are, independently of the base, 6 atoms of oxygen, and since to convert hydrogen into water requires one atom, to convert carbon into carbonic acid requires 2 atoms, and to effect an analogous change in sulphur requires 3 atoms, it follows that for every atom of hydrogen there will be 4 atoms of oxygen liberated, for every atom of carbon 3 atoms, and for every atom of sulphur 2 atoms. Each atom of oxygen is to the weight of nitrate of potassa as 8 to 102; hence there will be by hydrogen nearly 32 per cent., by carbon nearly 24 per cent., by sulphur 16 per cent. of oxygen evolved to act upon the excess of the contiguous combustible matter. Meanwhile it must be recollected that in gum, sugar, starch, and lignin (or fibre of wood, cotton, or linen), both hydrogen and oxygen exist in due proportion to generate water; and besides these compounds formed with oxygen, we have nitrogen to aid,* which is more incoercible than water or carbonic acid. Since at the heat produced by the combustion of hydrogen or carbon, with pure oxygen, iron, the most tenacious of all the materials at our command, is perfectly fusible, it is evident that by mechanism we cannot restrain the expansive force of the gaseous products producible as above represented. I believe I may say, that water has never been confined under a white heat. Yet the expansive force of liquid carbonic acid is at the freezing-point of water 36 times as great as the pressure of this liquid at its boiling-point. It has already been observed, that nitrogen in expansive violence must go beyond carbonic acid. It follows, that excepting the blow of a hammer, or the force created by gravitation in falling bodies, we have no means by which we can enable nitre, in a state of incandescent igneous fluidity, to come into close contact, *even for an instant*, with masses of combustible matter, like those which it was made to encounter in the store of Messrs. Crocker and Warren.

It is to be presumed that it has been the want of this force which has caused efforts to produce explosions between nitre and combustibles to fail; and it is to the presence of this force, where the fall of enormous masses of agglutinated combustible matter upon incandescent liquefied nitre may be reiterated, that I ascribe the destructive explosions, which, under such circumstances, have been so prolific of impoverishment, mutilation, and death.

* The power of decomposing incandescent nitre by aqueous vapor, which was inferred by me to exist in 1845, has since been fully verified by the employment of this vapor by an American chemist, Tilghman, to effect the decomposition of compounds containing potassa, or other alkaline bases capable of forming hydrates, *per se*, indecomposible by heat. (See Note, pages 151, 152.)

* Nitric acid consists of 1 atom of nitrogen as well as 5 of oxygen.

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ON A NEW SUBSTANCE ISOMERIC WITH STARCH.*

BY M. GOTTLIEB.

THE investigations which have hitherto been made on the composition of the organs of the inferior animals demonstrate that there exist in these organs neutral non-nitrogenous substances which have a remarkable analogy with the neutral matters of the vegetable organisation, starch or cellulose. The experiments of M. Gottlieb relate to a substance which exists in a kind of infusoria, *euglena viridis*, Ehr., and which is isomeric with starch.

This substance forms small grains which fill these infusoria, which are ordinarily of a green color, and which often give them the appearance of small vegetable cellules filled with grains of starch. When an euglena is crushed under a microscope, these grains are seen to issue in abundance. Tincture of iodine does not color them blue, which shows that they are not starch granules.

The euglenæ form green and foamy layers on the surface of the water which they inhabit. It is easy to collect them and to separate them, by mechanical operations; as by sifting from the vegetable matter and the greater part of the sand with which they are mixed. In order to purify them, and to isolate the granular matter, M. Gottlieb exhausts them with a mixture of alcohol and ether, then with ether, and finally with alcohol. These vehicles are colored green and leave a residue of an intense violet color. This violet color is removed by boiling the euglenæ with alcohol containing hydrochloric acid. During this treatment, many envelopes are removed, and let out the grains which it is desired to isolate. This is partly effected by suspending the matter in water and filtering it through a very fine cotton filter; but complete separation can be perfectly operated only by chemical means. When the mixture of membranes and grains is treated with a weak solution of potassa, the granular matter is dissolved, and may be precipitated by an acid from the alkaline solution under the form of a colorless jelly.

This matter, washed and dried, occurs under the form of small irregular pieces, transparent and analogous to gum. When heated, it enters into fusion and burns, giving out the odor of caramel, and leaving a charcoal which it is easy to incinerate. It is insoluble in ammonia. Alcohol precipitates it in white flocks from its solution in potassa, when it is concentrated. It swells up in water without dissolving. Concentrated hydrochloric acid converts it into fermentable sugar. The composition of this substance is exactly the same as that of starch and cellulose; it contains, according to the author's analyses:—

Carbon	C^{12}	44·28
Hydrogen	H^{10}	6·27
Oxygen	O^{10}	49·45
		100·00

The author proposes to designate this matter by the name of *paramidon*.

* *Annalen der Chemie und Pharmacie.*

ON THE CHEMISTRY OF ASSAFŒTIDA.*

BY HLASIWETZ.

WHEN assafœtida is treated with strong alcohol, the resin and volatile oil are completely dissolved, the gum and impurities (consisting chiefly of gypsum) remaining behind.

From the alcoholic tincture, the alcohol and volatile oil may be separated from the resin by distillation, so that the latter remains almost inodorous. If the distillation be performed with water in a copper still with a tin head, the tin becomes strongly acted on by the sulphur contained in the volatile oil. The distillation was, therefore, afterwards undertaken in a large glass retort, heated in a salt-water bath, in order to avoid the burning of the residue.

One pound of assafœtida of the best quality yielded, on the average, one ounce of volatile oil, equal to about three per cent. The volatile oil of assafœtida is a thin fluid of a light yellow, clear, and of a penetrating odor. It is very readily dissolved by strong alcohol; water also takes up a considerable quantity of it, from which reason the *aqua assafœtidæ* is particularly rich in oil, and has an acrid taste. Hlasiwetz found also valerianic acid and metacetonic acid in it. The volatile oil of assafœtida does not redden the skin as some other oils do which contain sulphur; it is also neutral to test paper. After it has stood for some time it evolves a large proportion of sulphuretted hydrogen; this property it imparts to crude assafœtida. It does not congeal by artificial cold. Its boiling-point cannot be exactly determined, for, when heated, it developes, before and during boiling, sulphuretted hydrogen, and thus becomes decomposed. This boiling, however, takes place at 266° to 284° F. When fresh, it consists of carbon, hydrogen and sulphur, without oxygen;

* *Buchner's Repertorum.*

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but if exposed for some time to the atmosphere, it becomes slightly acid, and its odor is slightly altered.

Repeated analyses of the crude volatile oil prove that its percentage composition varies with the method of obtaining it, and according to its age: the carbon varied from 64·24 to 69·27; the hydrogen from 9·09 to 10·48; the sulphur from 20·17 to 25·43 per cent., so that, according to these results, a compound of a higher and of a lower proportion of sulphur with one and the same radical may be calculated according to the following formulæ:—

I.	II.	III.	IV.
$C^{12}H^{11}S^2$	$3(C^{12}H^{11}S^2)$	$5(C^{12}H^{11}S^2)$	$C^{12}H^{11}S^2$
$C^{12}H^{11}S$	$C^{12}H^{11}S$	$2C^{12}H^{11}S^2$	$2(C^{12}H^{11}S)$

Hlasiwetz has examined the relations of this oil to various agents, *e. g.*, ammoniacal gas, sulphuret of potassium, muriatic acid, chlorine gas, nitric acid, chromic acid, sulphurous acid, potassium, lime, soda, oxide of silver, oxide of lead, and chloride of platinum, and he most carefully analysed the numerous results he obtained.

The resin of assafœtida is dirty white; in the air it soon becomes pink-red; in concentrated sulphuric acid it is dissolved with a green color; water throws it down from this solution in the form of pink-red flocculi; heated in a retort, it loses first the water adhering to it and a small quantity of volatile oil, which possesses the smell of assafœtida. At the same time it froths much, and developes sulphuretted hydrogen. As soon as all the water is expelled, the froth disappears, the resin becomes dark brown and boils steadily. The oils which now distil over during the decomposition of the resin are partly green, blue, violet-red, and of a more or less aromatic odor; diluted caustic potassa lye is colored yellow by them and becomes turbid. The violet portion communicates to the potassa lye an oil, which becomes intensely red in the air. The potassa liquor with which the oils have been washed contains, besides sulphuretted volatile oil, chiefly formic acid, and a trace of acetic acid.

The gum of assafœtida is, when dry, grey and horny, and yields, by dry distillation, formic acid, with a small quantity of acetic acid and a kind of tar containing sulphur.

Formic and acetic acids were also obtained by treating the red volatile oil of assafœtida with caustic soda. Valerianic acid and metacetonic acid could not be discovered in it; but, upon heating the soda lime in the oil-bath to 406° F., and allowing the volatile oil to drop on it, a volatile oil of a smell similar to lavender was formed, and valerianic acid, together with metacetonic acid and acetic acid, remained behind in combination with the soda lime.

PRESENCE OF URIC ACID IN BLOOD IN HEALTH AND DISEASE.*

BY DR. GARROD.

Dr. Garrod has made the interesting discovery that uric acid exists in the blood, both in gout and even in the healthy state. The form in which it exists in that liquid is that of urate of soda.

The following is the process employed by Dr. Garrod:—1000 grs. of the serum were evaporated to dryness in thin layers in the water-bath. The residue was powdered and treated with rectified spirit, boiled for about 10 or 15 minutes, again treated in the same way, and the spirituous solutions preserved for examination. After again washing with spirit, the dried serum was exhausted with boiling water, the operation being repeated two or three times, and the watery solutions mixed. On evaporating a small quantity of this liquid with the addition of nitric acid, and holding the residue over the vapor of ammonia, distinct evidence of the existence of uric acid was afforded by the production of the beautiful tint of murexide. The aqueous solution was then evaporated until it became slightly thick, and when cool was acidulated with muriatic acid. On standing for some hours, crystals of uric acid were deposited; these were collected, washed with alcohol, and weighed. When the above process was followed without the addition of the acid, the concentrated aqueous solution was found to deposit crystals of urate of soda in the form of tufts of needles.

In four cases of gout, the quantity of uric acid in 1000 grs. of serum was found to be as follows:—

I.	II.	III.	IV.
0·050 gr.	0·025 gr.	0·045 gr.	0·030 gr.

The author arrives at the following conclusions regarding the relation of uric acid to gout:—

1. The blood in gout contains uric acid in the form of urate of soda, which, as has been shown, can be obtained from it in a crystalline state.

2. The uric acid is diminished in the urine immediately before the gouty paroxysm. This was shown by the examination of the urine of the patient from whom the blood (IV.) had been removed. For several days,

* *Trans. Med. Chir. Soc. of London*, Feb., 1848.

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at the commencement of the gouty attack, no uric acid could be detected in it, although on the third day a trace could be discovered by the murexide test, and a few crystals were deposited, whilst the blood during this time gave abundant evidence of its presence. When the attack had subsided, the uric acid was present in the urine in its normal quantity.

In the urine of the patient (II.) when the attack was passing off, the uric acid amounted to 0·050 gr. only; hence not more than one-twelfth of the natural quantity. The same fact was proved to occur in other cases.

3. In patients subject to chronic gout with topacheous deposits, the uric acid is always present in the blood and deficient in the urine, both absolutely and relatively to the other organic matters; and the chalk-like deposits appear to depend on an action in and around the joints, &c., vicarious of the "uric-acid-excreting" function of the kidneys.

4. The blood in gout sometimes yields a small portion of urea (no albumen being present in the urine), as shown by the crystallisation with nitric acid.

The quantity of uric acid in the blood of healthy persons, or at least those suffering from slight headache or other trifling affections, was found to amount, per 1000 grs. of serum, in one case to 0·007 gr., in another to a trace only; in two patients suffering from slight paralysis and an ill-conditioned habit of body, to 0·010 gr. No trace could be found in the blood of the sheep nor in that of the pigeon; the urine of the former contains no uric acid, whilst that of the latter consists entirely of urate of ammonia.

The author moreover found, in several examinations of perfectly healthy blood, that uric acid was invariably present.

It appears, then, from these experiments, that in health (or tolerable health) uric acid can be detected in the blood of the human subject. It appears also, that when the function of excretion is very perfectly performed, no trace can be detected, although, as in the case with birds, the amount of uric acid formed in the system is very large.

In regard to rheumatism, the author found the blood to contain no more uric acid than in health; and no urea could be detected in 1000 grs. of serum.

In cases of albuminuria, uric acid is always present in the blood; the quantity however varying. When the functions of the kidneys are much impaired, it exists in quantities almost as great as in gout; in other cases its amount is small, but it usually exceeds that found in ordinary blood. Urea always exists in large quantities in this blood, as is well known, and no relation is found between the amounts of urea and uric acid. In the examination of the blood in albuminuria, some of the coloring matter of the urine seemed to be thrown down with the uric acid in all cases. The author regards the quantities of uric acid found by him in the blood in his earlier experiments as rather below the true amounts. He recommends that the crystals should not be collected until forty-eight hours have elapsed.

The author suggests whether, in doubtful cases, it might not be possible to determine as to the presence of gout or rheumatism from an examination of the blood.

ON SEA-WEEDS AS THE SOURCES OF ACETIC ACID.

BY JOHN STENHOUSE, LL.D., F.R.S. L. AND E.

DURING the course of a series of experiments on sea-weeds, an account of which was read before the Royal Society on the 18th of April, 1850, I had frequently occasion to observe that when a quantity of wet sea-weeds was laid together in a heap in a warm situation for any length of time, it soon began to undergo a species of fermentation. This, I am aware, is a circumstance which has been not unfrequently observed; but as no one has hitherto been at the trouble to examine the nature of the acids generated during this fermentation, I was induced to investigate the matter a little more closely.

At the ordinary temperature of Scotland, even during the summer months, the fermentation of sea-weeds proceeds very slowly, requiring from three to four months for its completion; but when the weeds are kept at a temperature of from 90° to 96° F. the process is completed in from two to three weeks.

I. Six pounds of fresh moist *Fucus vesiculosus* were put into an earthenware jar along with a little quicklime, and just sufficient water to cover them, and were kept for three weeks at the temperature of 96° F. Small quantities of quicklime were added from time to time, so as to keep the mixture slightly alkaline. When the fermentation was completed, the liquid portion, which contained a good deal of mucilage and some acetate of ammonia, was thrown upon a cloth filter, and the clear liquid which passed through was evaporated to dryness and then cautiously heated, so as not to decompose any of the crude acetate of lime, while

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almost the whole of the mucilaginous was rendered insoluble. The dark brown mass was digested with a little water, again filtered, and the clear solution evaporated to dryness. It yielded 4 oz. 2 drams of dry acetate of lime, which was almost entirely free from adhering organic matter. When this acetate of lime was distilled with hydrochloric acid, it yielded 29 oz. of a pure but feeble vinegar, 1 oz. of which required 24 grs. anhydrous carbonate of soda to neutralise it. As, therefore 662 grs. of anhydrous carbonate of soda require for saturation 650 grs. of anhydrous acetic acid, 1 grain of anhydrous carbonate of soda may be regarded as equivalent to 1 gr. of anhydrous acetic acid. The 29 oz. of the abovementioned vinegar, therefore, contained 24 × 1 × 29 = 696 grs. of anhydrous acetic acid. As 1 pound contains 7000 grs., and 6 pounds of fucus consequently 42,000 grs., the 696 grs. of anhydrous acetic acid obtained from it give 1·65 per cent. anhydrous acetic acid as the produce of the wet seaweed.

II. Twenty-four pounds of fresh *Fucus nodosus*, also in a moist state, were suffered to ferment along with lime at a temperature of 96° F. for about five weeks. Twenty ounces of crude acetate of lime were obtained, which, when distilled with hydrochloric acid, yielded 57 oz. of pretty pure vinegar, each ounce of which saturated 43 grs. of anhydrous carbonate of soda. The amount of the acetic acid in the whole quantity was therefore 2451 grs.=1·45 per cent. of the wet Fucus nodosus.

III. Four pounds of fresh *Fucus vesiculosus* were left to ferment in the open air along with quicklime, at the ordinary temperature, from the 8th of June to the 1st of September, when the process was finished. The filtered solution of the acetate of lime, after being evaporated to dryness, when distilled with hydrochloric acid, yielded 46 oz. of weak vinegar, each ounce of which saturated 7 grains of anhydrous carbonate of soda, amounting therefore in all to 322 grs. of anhydrous acetic acid=1·15 per cent. of the wet sea-weed. Thus it is clear that when sea-weeds are fermented at the ordinary temperature of Scotland, during the summer months the process goes on much more slowly, and yields a considerably smaller product than when the temperature is retained at about 90° F. Should any person, therefore, think of manufacturing acetic acid from sea-weeds, either in Great Britain or in any of the northern countries of Europe, I would advise him to employ so much artificial heat as to produce a constant temperature of from 90° to 96° F. I should expect, however, that in the southern portions of Europe, at least during the summer months, and in tropical countries, artificial heat might probably be dispensed with.

One of the chief uses to which sea-weeds are applied is in manuring land; and with this application, their having been previously employed in the manufacture of vinegar would not very materially interfere; for if the fermented weeds and the salts remaining in the still were spread upon the land, I apprehend they would prove almost as useful in an agricultural point of view as the fresh sea-weeds would have done.

The vinegar obtained from the Fuci contained a very minute quantity of butyric acid. When it was therefore saturated with carbonate of soda, evaporated to dryness, and the dry salt left for some time in a moist atmosphere, a small portion of it deliquesced. This liquid portion was therefore separated from the solid salt, and was evaporated to dryness. It formed a saponaceous-looking, uncrystallisable mass, which had the peculiar odor of the butyrates; and when it was digested in a mixture of alcohol and sulphuric acid yielded an ether which had the characteristic odor and properties of butyric ether. A silver salt, prepared from this supposed butyrate of soda by double decomposition with nitrate of silver, was found to contain 60·49 per cent. oxide of silver. The calculated quantity of oxide of silver in butyrate of silver, is 59·48; that in acetate of silver, 69·46; and in metacetonate of silver, 64·09 per cent. It appears highly probable, therefore, that the excess of oxide of silver found in the butyrate arose from a slight admixture of either acetic or metacetonic acids.

A silver salt was also prepared by digesting oxide of silver with pure acetic acid from the Fuci. It had all the characters of acetate of silver; and when subjected to analysis, 0·250 of the salt gave 0·161 metallic silver=0·172 oxide of silver=69·16 per cent.; the calculated amount of oxide of silver in the acetate being, as was previously stated, 69·46 per cent.

Glasgow, Nov. 26th, 1850.

ON GITHAGIN.*

BY DR. E. A. SCHARLING.

DR. SCHARLING has extracted from corncockle (*Agrostemma githago*) a peculiar

* *Central Blatt* and *Pharmaceutical Journal*.

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poisonous principle, to which he has given the name of *githagin*.

The seeds of corncockle contain *githagin*, *fatty oil*, *gluten*, *sugar*, *gum*, *starch*, *vegetable albumen*, and the usual salts of the vegetable kingdom.

Githagin, when dry, resembles starch, but has a more silky appearance, and under the microscope appears somewhat crytalline. It is odorless and almost tasteless: after a short time a burning sensation is felt on the palate. It does not act on vegetable colors. It is soluble in water and dilute spirit, but is insoluble in absolute alcohol and in ether. It is reddened by sulphuric acid like salicine. Its aqueous solution yields a precipitate with subacetate of lead.

Githagin acts as a poison on the smaller animals. A few drops of a solution (three grains of githagin in a drachm of water) killed a canary bird in twenty-four hours. A solution of ten grains killed a rabbit. Ten grains of githagin merely caused vomiting in a dog.

ON POTASSIO-GYPSITE, A DOUBLE SULPHATE OF POTASSA AND LIME.*

BY J. ARTHUR PHILLIPS, ESQ.

THIS substance is obtained as a secondary product in the manufacture of tartaric acid, and it will therefore be necessary to describe the circumstances under which it is produced, before detailing the properties and composition of the salt itself. Tartaric acid is, as is well known, made from the impure bitartrate of potassa, which reaches this country in such a state as to yield, on an average, 72 per cent. of crystallised acid.

The processes employed in the manufacture are briefly as follows: Into a large tun, capable of containing about three thousand gallons of water, are thrown from fourteen to fifteen hundred pounds of mashed chalk, which is agitated by means of a revolving arm, until the water and carbonate of lime have become perfectly incorporated, and a finely-divided mixture is obtained. When this is effected, about two tons of crude tartar are added, by means of an air-tight trap on the top of the vessel, and by the aid of heat, obtained by blowing a jet of steam into the mixture, and constant agitation of the mass, the bitartrate of potassa is made to transfer its free atom of acid to the lime, giving rise to insoluble tartrate of lime, soluble tartrate of potassa, and the evolution of carbonic acid, which is conveyed away in leaden pipes to be employed in making bicarbonate of soda. As soon as the decomposition is completed, a sufficient portion of sulphate of lime, from a preceding operation, is added, for the purpose of decomposing the neutral tartrate of potassa in solution. By the aid of heat and long-continued agitation, this is at length effected, and the vessel then contains a solution of sulphate of potassa, together with the insoluble tartrate of lime, and small portions of the carbonate and sulphate of the same base, arising from the excess of these reagents originally employed. At this period of the manufacture, the agitation is arrested, the liquor is allowed to settle down, and the sulphate of potassa drawn off from the tartrate of lime, which remains at the bottom of the tub. This is subsequently washed with three successive waters, which are added to the solution of sulphate of potassa at first obtained. The insoluble tartrate of lime is afterwards decomposed by sulphuric acid, with formation of sulphate of lime and production of free tartaric acid, which is crystallised in the usual way, whilst the sulphate of potassa, with which we are at present most interested, is conveyed away by large leaden gutters for evaporation.

At the manufactory of the Messrs. Pontifex, these liquors are first drawn into a large tubular steam-boiler, heated by the waste heat escaping from a set of coke-ovens. In this the potassa solution is concentrated to about two-thirds of its original volume, and then allowed to run into a series of large bacs containing coils of iron pipe, which are supplied with steam by means of the boiler in which the liquor is concentrated, and in these the evaporation is completed.

This boiler for concentration and supplying the steam-coils, gradually becomes coated by a hard deposit, in order to remove which, it becomes necessary, at intervals of about three months, to stop the ovens and run out the liquor. On these occasions, the cooling of the boiler and its contents is extremely slow, as the mass of brickwork which surrounds it renders the loss by radiation very inconsiderable. When it has sufficiently cooled, and the liquor has been run off, the greater part of its internal surface is found to be covered with transparent lamellar crystals, formed on a hard crystalline gangue. These are sparingly soluble in water, but are easily dissolved by dilute hydrochloric acid.

A qualitative analysis showed them to consist of lime, potassa, water, and sulphuric acid, and a quantitative examination gave the following results:—

* *Quarterly Journal of the Chemical Society*, January, 1851.

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FIRST ANALYSIS.

10·05 grs. gave 14·85 grs. platinum-salt.
,, ,, 3·05 ,, carbonate of lime
9·28 ,, 0·51 ,, water.
,, ,, 13·22 ,, sulphate baryta.

SECOND ANALYSIS.

10·23 grs. gave 15·10 grs. platinum-salt.
,, ,, 3·10 ,, carbonate of lime
5·81 ,, 0·33 ,, water.
,, ,, 8·21 ,, sulphate baryta.

These numbers afford the following per-centage results:—

Potassa	28·52	28·57
Lime	16·99	16·96
Sulphuric acid	48·94	48·55
Water	5·51	5·67
	99·96	99·75

The above relations would lead to the empirical formula $KO, SO^3 + CaO, SO^3 + HO$, as may be seen by comparison with the following calculated amounts:—

	No. of eqs.		Amounts.	Per-centage.
Potassa	1	=	47	28·67
Lime	1	=	28	17·02
Sulphuric acid	2	=	80	48·82
Water	1	=	9	5·49
				100·00

Since, however, a variety of sulphate of lime, expressed by $2(CaO, SO^3) + HO$, has been found under nearly similar circumstances,* it appears probable that, in reality, the water is divided between the sulphates of lime and potassa, and that the crystals are composed of a double di-hydrated salt, of which the true formula is represented by $2(KO, SO^3) + HO + 2(CaO\,SO^3) + HO$, and to this I propose to give the name of *Potasso-gypsite*.

Professor W. H. Miller, of Cambridge, who has had the kindness to examine the crystals of this substance, describes them as follows:

The crystalline gangue, on which the regular crystals are formed, was found, on analysis, to yield the following results:—

FIRST ANALYSIS.

28·95 grs. gave 0·23 grs. silica.
,, ,, 12.49 ,, carbonate of lime.
,, ,, 1·19 ,, phosphate of magne-
37·86 ,, 2·95 ,, carbonic acid [sia.
,, ,, 41·96 ,, sulphate of baryta.
,, ,, 39·63 ,, platinum-salt.
,, ,, 0·31 ,, chloride of sodium.
24·12 ,, 0·30 ,, oxide of iron.
,, ,, 0·18 ,, alumina. [nesia.
75·83 ,, 0·58 ,, phosphate of mag-

SECOND ANALYSIS.

26·23 grs. gave 0·25 grs. silica.
,, ,, 0·28 ,, oxide of iron.
,, ,, 0·21 ,, alumina.
25·57 ,, 0·87 ,, phosphate of magne-
24·12 ,, 1·90 ,, carbonic acid [sia.
,, ,, 26·20 ,, platinum salt.
,, ,, 0·30 ,, chloride of sodium.
,, ,, 9·34 ,, sulphate of baryta.
,, ,, 0·17 ,, phosphate of mag- [nesia.

	I.	II.
Potassa	20·18	20·93
Soda	0·43	0 61
Lime	24·16	,,
Magnesia	1·50	1·24
Alumina	0·74	0·80
Oxide of iron	1·24	1·06
Silicic acid	0·79	0·80
Sulphuric acid	38·08	38·66
Phosphoric acid	0·49	0·42
Carbonic acid	7·79	7·87
Water	4·31	,,
Organic matter	traces	traces
	99·71	

These numbers indicate that the uncrystallised portion of the deposit consists of the same substances as the crystals themselves; and if, in the first analysis, we so arrange them as to form the double sulphate above described, the following percentages will be obtained:—

	I.	II.
New salt	64·76	
Sulphate of lime	11·57	
Carbonate of lime	14·06	
Phosphate of lime	1·06	
Carbonate of magnesia	3·10	
Silicate of potassa	2·42	
Oxide of iron	1·24	
Alumina	0·74	
Water	0·76	
Organic matter	traces	
	99·71	

In the analysis of the crystals of the pure salt, the water was estimated by heating to redness, in a platinum crucible, a portion of the substance which had been kept until it ceased to lose weight under the receiver of the air-pump, in which was placed a dish of strong sulphuric acid. The same portion of substance was then dissolved in dilute hydrochloric acid, and the sulphuric acid thrown down as sulphate of baryta by chloride of barium in the usual way. A second quantity of substance was then taken, and after dissolving it in dilute hydrochloric acid, and adding ammonia, the lime was precipitated in the form of oxalate, and weighed as carbonate. The filtrate

* Johnston, *Phil. Mag. J.* xiii. 325; also *J. Pr. Chem.* xvi. 100.

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from the oxalate of lime was then evaporated to dryness, and the residue heated to redness to expel the ammoniacal salts. A slight excess of hydrochloric acid was afterwards added, and the potassa estimated as platino-chloride of potassium.

In the investigation of the uncrystallised deposit, the ordinary routine of chemical analysis was employed, the phosphoric acid being estimated by the method of Fresenius, and the alkalis separated from the alkaline earths by the use of hydrate of baryta.

ON A METHOD OF DETERMINING THE EFFECTIVE HARDNESS OF EMERY, WITH OBSERVATIONS ON ITS CHEMICAL COMPOSITION.*

BY J. LAWRENCE SMITH.

FRAGMENTS are broken from the piece to be examined, and crushed in a diamond mortar with two or three blows of a hammer, then thrown into a sieve (the one employed had four hundred holes to the square centimetre), the portion passing through is collected, and that remaining on the sieve is again placed in the mortar and two or three blows given, then thrown into the sieve; the operation is repeated until all the emery has passed through the sieve. The object of giving but two or three blows at a time is to avoid crushing any of the emery to too fine a powder.

Thus pulverised, it is intimately mixed, and a certain portion of it is weighed (as I operated with a balance sensible to a milligramme, the quantity used never exceeded a gramme). To test the effective hardness of this, a circular piece of glass about 4 inches in diameter and a small agate mortar are used. The glass is first weighed, and placed on a piece of glazed paper; the pulverised emery is then thrown on it little by little, at each time rubbing it against the glass with the bottom of the agate mortar.

The emery is brushed off the glass from time to time with a feather, and when all the emery has been made to pass once over the glass, it is collected from the paper and made to pass through the same operation, which is repeated three or four times. The glass is then weighed, after which it is subjected to the same operation as before, the emery being by this time reduced to an impalpable powder. This series of operations is continued until by repeated weighing the loss sustained by the glass is reduced to a few milligrammes. The total loss in the glass is then noted; and when all the specimens of emery are submitted to this operation under the same circumstances, we get an exact idea of their relative hardness.

The blue sapphire of Ceylon was pulverised and experimented with in this way; it furnished me with a unit of comparison by which to compare the results obtained. This operation is long but certain, and for the harder varieties of emery it is necessary to repeat the rubbing six or seven times, and it requires nearly two hours for completion.

The results that I have obtained are interesting, and have furnished me with the means of forming conclusions that I could not otherwise have come at.

Glass and agate have not been chosen for this experiment without a certain object, as experiments were first made with two pieces of agate, with two pieces of glass, and with metal and glass. The agates were found too hard, as they crushed the emery without producing hardly any abrasive effect; the others were found not to crush the emery sufficiently, making the experiment tedious and long. With the glass and agate we have a hard substance which crushes the emery, and in a certain space of time reduces it to such an impalpable state that it has no longer any sensible effect on the glass, and on the other hand the glass is soft enough to lose during this time sufficient of its substance to allow of accurate comparative results. In the employment of this method in the arts, it would not be necessary to go to the sapphire for a standard of comparison; any good emery would answer the purpose quite as well.

It must be understood that this method of coming at the abrasive effects of emery does not furnish the mineralogical hardness of this substance, by which we understand the hardness of any individual particle, as evinced by its effect on a substance of less hardness, without regard to the molecular structure of the mineral. Two minerals possessing the same hardness, but differing in structure, one being friable and the other resisting, will be found very different in their abrasive effects: for instance, break a piece of quartz in two; subject one of the pieces to a white heat, and after cooling compare the two by rubbing the point against some hard substance; both will be found to scratch equally well. Then try the two in a state of powder, by rubbing them between two pieces of glass that have been weighed, and the difference of their abrasive effects will be found very great, because the one subjected to the fire is exceedingly friable, and becomes readily crushed to an impalpable powder. This fact is eminently

* Silliman's *Journal*, November, 1850.

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true with reference to emery, many specimens of which containing the same amount of corundum differ somewhat in their *effective hardness*, owing to the more or less compact structure of the corundum.

By the method with the agate and glass I have found the best emery capable of wearing away about one-half its weight of the glass (that used was the common French window glass). The sapphire under the same circumstances wears away more than four-fifths of its weight. A tabular view of the results will be given a little further on.

CHEMICAL COMPOSITION.

This substance consisting of a mixture of corundum and oxide of iron in various proportions, it is easy to see what its composition must be. Yet the chemical examination of this mineral, taken in connection with other properties, is not devoid of interest.

For the purpose of analysis, the emery was reduced to a state of powder, in the manner alluded to in speaking of its hardness, with a diamond mortar and sieve. The powder was dried for twenty-four hours over sulphuric acid; a gramme was then weighed in a small platinum crucible of about one-fourth of a cubic inch in capacity, fitted with a cover that adapted itself well to it; this small crucible was placed in another of earth, and the space between the two filled with pulverised quartz, which also covered the smaller one to the depth of half an inch. Common sand was not used, because during the heating some particles might adhere to the platinum crucible by a semifusion; nor was powdered charcoal employed, because it protected the mineral no better than the pulverised quartz from contact with the air; at the same time a little risk was run in decomposing a small amount of the iron.

Thus arranged, the crucibles were heated to a bright red for from thirty minutes to one hour. After cooling, the platinum crucible was carefully withdrawn and weighed. The loss furnished me with the amount of water in the emery.

It requires a continued red heat to drive out all the water, a circumstance which is true for a number of minerals, particularly for those containing a large amount of alumina, as diaspore and some micas.

The powder, of which the water has been estimated, was next submitted to levigation in a large agate mortar placed on a surface of glazed paper; and when completed, it was carefully detached from the mortar, placed in a platinum capsule, heated gently to drive off any hygrometric moisture, and weighed; the increase of weight furnished the amount of silica taken from the mortar.

The levigation of 1 grm. was accomplished in two operations, each requiring about twenty minutes; and by using a mortar of convenient size and the extremity of a feather or a small brush, it is possible to lose but an insensible quantity of the mineral, and to estimate with sufficient precision the amount of silica abraded from the mortar.

Another method by which I accomplished the levigation in some of the analyses, was in a steel mortar of the same form as the agate mortar; and when completed, the powder was placed in a glass with nitric acid diluted with 30 times its weight of water, and left in it for one hour, agitating it occasionally. The iron taken from the mortar was dissolved, and no part of the mineral attacked. The next thing was to filter, and continue the analysis with the substance thus freed from the iron of the mortar, without any second weighing.

Of these two methods I prefer to employ the first for the emery, as it is more expeditious, and almost, if not quite, as exact as the second. There are however occasions in which the steel mortar should be resorted to.

The substance once reduced to an impalpable powder, it was necessary to render it *completely* soluble, and my researches to arrive at this were long and tedious. In trying the various known methods, the most successful was found to be that with a mixture of carbonate of soda and caustic soda heated to whiteness for one hour; nevertheless I could not obtain a complete decomposition. The decomposition might probably be completed if the levigation was made more thoroughly; but it is easy to understand, that with a large number of analyses of the same substance to make, it was a desideratum on my part not to consume the best part of the day in the levigation of a single gramme; particularly as I did not wish to confide this operation to another, as much care was required to lose nothing during the levigation. Mixed with carbonate of baryta, and heated in a forge, the decomposition of the mineral was far from being complete; the same may be said for the treatment with the caustic alkalies in a silver crucible.

The bisulphate of potassa decomposes it almost entirely by a single operation, but unfortunately a double salt of potassa and alumina is formed, which is almost insoluble in water or in the acids, and it is only by a solution of potassa that it is first decomposed, and afterwards redissolved. I will not stop to detail all the disadvantages attending this method, but will at once

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speak of the method which gave me very easily the most accurate results.

It is by means of the bisulphate of soda that all my analyses of emery, of corundum, and of several aluminates, were made. I believe that I am the first who has shown the great advantage of using this double salt in the decomposition of certain substances insoluble in the acids; and very probably it will replace in most cases the use of the bisulphate of potassa in analytical chemistry. At present, all the advantages that may arise from the substitution of the soda for the potassa salt cannot be mentioned; all that I will say is, that the former, in giving a decomposition at least as complete as the latter, furnishes a melted mass quite soluble in water; and in the future operations of the analyses there is no embarrassment from a deposit of alum.

The bisulphate of soda was prepared by adding an excess of pure sulphuric acid to the pure carbonate or neutral sulphate of soda, and heating it in a capsule until all the water had been expelled and sufficient of the acid to allow of the mass becoming solid on cooling. That obtained in commerce is not sufficiently pure.

The pulverised emery is placed in a large platinum crucible with 6 or 8 times its weight of bisulphate of soda, and the mixture is heated over a lamp in the same manner and with the same precautions as are employed when using the bisulphate of potassa. From 15 to thirty minutes suffice for the operation. The mass is allowed to cool, and water with a few drops of sulphuric acid are added to it, and the whole heated, when it soon dissolves with the exception of a little silica, that renders the solution milky, and a small quantity of undecomposed mineral, that is readily detected by rubbing a glass rod against the bottom of the capsule. The liquid is now filtered, and the filter is washed once with a little water; then with its contents it is placed in a platinum crucible, burnt completely, and the residue is heated with a little bisulphate of soda, which completes the decomposition; and when treated with water and a drop or two of sulphuric acid, all except the silica is dissolved. The liquid which passes the filter in this case is added to the first, and the analysis continued. The silica obtained is diminished by the quantity taken up from the mortar in order to arrive at what is actually contained in the mineral. The filtered solution is heated with a little nitric acid to convert all the protoxide of iron into peroxide, then treated with an excess of caustic soda, and a little carbonate of the same alkali; this redissolves the alumina first precipitated, and thus separates it from the oxide of iron and a trace of lime. The iron and lime are separated in the ordinary way; the alkaline solution of alumina was acidulated, and the alumina precipitated with carbonate of ammonia.

Thus analysed, the emery from different places gave the following results:—

No.	Localities.	Effective hardness. Sapphire 100.	Spec. gravity	Chemical composition.					
				Water.	Alumina.	Oxide of iron.	Lime.	Silica.	Total.
1	Kulah.....	57	4·28	1·90	63·50	33·25	0·92	1·61	101·18
2	Samos.....	56	3·98	2·10	70·10	22·21	0·62	4·00	99·03
3	Nicaria.....	56	3·75	2·53	71·06	20·32	1·40	4·12	99·43
4	Kulah	53	4·02	2·36	63·00	30·12	0·50	2·36	98·34
5	Gamuch.....	47	3·82	3·11	77·82	8·62	1·80	8·13	99·48
6	Naxos	46	3·75	4·72	68·53	24·10	0·86	3·10	101·31
7	Nicaria.....	46	3·74	3·10	75·12	13·06	0·72	6·88	98·88
8	Naxos.....	44	3·87	5·47	69·46	19·08	2·81	2·41	99·23
9	Gamuch.....	42	4·31	5·62	60·10	33·20	0·48	1·80	101·20
10	Kulah.....	40	3·89	2·00	61·05	27·15	1·30	9·63	101·13

I ought to mention that the analysis afforded other substances in small quantities in some of the emeries; as titanic acid, oxide of manganese, oxide of zirconium and sulphur (existing in pyrites); but these substances are unimportant in the composition of emery, and are in such minute quantities, that it is necessary to operate on a considerable quantity of the mineral to obtain satisfactory results concerning them.

The analyses marked 6 and 8 were made by decomposing the emery as it came from the sieve, without pulverisation in the agate mortar. It was by accident that it occurred, and I was not aware of the neglect until it was fused with the bisulphate of soda; but not wishing to lose the analysis, the operations were continued as in the other cases,

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only using a little more of the bisulphate in the second decomposition; and, somewhat to my surprise, the decomposition was quite as perfect as in the other cases. I had nearly completed all my analyses in the manner detailed when this fact became known, so that I have but these two cases to report.

The water which was found in the emery comes from the corundum. A very minute quantity of what has been estimated as water might be a little oxygen lost by the oligiste which is sometimes found in emery. Those emeries which contain the least water, everything else alike, are the hardest, as instanced by that from Kulah, notwithstanding the quantity of iron which it contains. The silica existing in emery is most often in combination with the alumina or oxide of iron, or with both; for this reason we must not always regard the quantity of alumina as an indication of the quantity of corundum in the emery.

COMPOSITION OF MINIUM.*

BY PROF. MULDER.

THE composition of minium may be represented by two different formulæ: according to M. Dumas, this oxide contains Pb^3O^4, and should be regarded as a combination of $2PbO$ with PbO^2:—

$$Pb^3O^4 = 2PbO + PbO^2.$$

M. Winkelblech thinks, on the contrary, that minium contains sesquioxide of lead combined with protoxide:—

$$Pb^3O^4 = PbO + Pb^2O^3.$$

This sesquioxide, Pb^2O^3, exists and has been prepared by M. Winkelblech by adding hypochlorite of soda to a solution of oxide of lead in potassa.

M. Houton-Labillardière examined a red and crystallised combination prepared in a minium furnace, the composition of which was expressed by the formula:—

$$Pb^4O^5 = 2PbO + Pb^2O^3, \text{ or } 3PbO + PbO^2.$$

Finally, M. Longchamps examined a species of minium, which contained:—

$$Pb^6O^7 = 4PbO + Pb^2O^3, \text{ or } 5PbO + PbO^2.$$

From the foregoing it is evident that the composition of minium is variable. M. Mulder has analysed seven different kinds of minium, either by calcining that oxide and determining the loss of weight, or by treating it with nitric acid and weighing the peroxide left as a residue.

The first process of analysis did not give accurate results, for minium always contains small quantities of carbonic acid, which is disengaged with the oxygen.

From M. Mulder's experiments, it results that most miniums have the composition $Pb^4O^5 = 2PbO + Pb^2O^3$, or $3PbO + PbO^2$, assigned to them by Houton-Labillardière.

* *Journal für praktische Chemie.*

CONTRIBUTIONS TO THE HISTORY OF THE PANCREATIC JUICE.*

BY M. J. L. LASSAIGNE.

IT is known, from the interesting researches of MM. Bernard and Barreswil, that the pancreatic juice possesses the remarkable property of forming into emulsion fatty bodies of vegetable and animal origin, and of converting them into fatty acids and glycerine, at the temperature of 100° F.

M. Bernard, in repeating lately, at the School of Alfort, in concert with M. Colin, principal anatomist of that establishment, the process by means of which he obtained it from animals, was kind enough to send me a small quantity of that juice, which he had himself extracted from an ordinary sized dog.

The experiments to which we submitted it have enabled us to add some facts to those already known to physiologists, the principal of which may be summed up in the following propositions:—

1. The action of the pancreatic juice on the oils is exerted even at the temperature of 53 to 59° F. in a few hours. Indeed, by moistening at several points a piece of blue litmus paper, with emulsion produced with olive oil and pancreatic juice, the moistened parts of the blue paper turned red by degrees from the circumference to the centre in presence of the air, and it is not necessary to maintain the mixture of oil and pancreatic juice for 12 or 14 hours, at the temperature of 100° F., as stated by the above-mentioned authors.

2. At the temperature of 59° F., the mixture of pancreatic juice and olive oil acidifies, after an equal time, in the vessels which contain it.

3. This acidification is produced in various gases, such as oxygen, hydrogen, nitrogen and oxide of carbon; the air does not seem, therefore, to participate in this singular reaction, which is perhaps due to a force of the same nature as that designated by Berzelius, under the name of *catalytic force*, and of which inorganic and organic chemistry present examples.

4. The pancreatic juice may retain its feeble alkalinity and its property of acting on the oil for several days.

* *Comptes Rendus.*

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5. When the oil is modified by the contact of the pancreatic juice, sugar and gum, dissolved in that fluid, retain their neutrality, which denotes the entirely special action which it exerts on fatty bodies.

ANALYSIS OF SUGAR FECULENCIES.

BY T. J. HERAPATH, F.C.S.*

Ashes 13·574	Water	48.940
	Organic matter	37.486
	Carbonate of potassa	0·146
	Sulphate of soda	0·155
	Chloride of sodium and chloride of potassium	0·237
	Carbonate of lime with some carbonate of magnesia	3.964
	Sulphate of lime	1·231
	Phosphate of lime with some phosphate of magnesia	2·679
	Phosphate of iron and alumina	1·320
	Siliceous residue, &c., insoluble in acids	3 842
		100·000

100 grains of the dried matters were found to contain 5·42 grs. of nitrogen; consequently, the feculencies in their normal state contain 2·805 per cent.

The exhausted animal charcoal, from the same refinery, was found when dried, to contain 2·82 per cent. of nitrogen.

ON THE PHYSICAL DISTINCTION OF MAGNETIC AND DIAMAGNETIC BODIES.

BY DR. VON FEILITZSCH.

DR. FARADAY, to whom the following communication was addressed, transmitted it to the Editors of the *Philosophical Magazine* for publication in that excellent periodical, stating that he refrains from making any comment on the views of the author, his sole desire being to establish the date of a new theory, and that he has "left it almost in the author's language, that he might not misstate his views;" and we give insertion to it with the same view.

Greifswald in Prussia, Dec. 3, 1850.

SIR—If the statement of a new theory constitutes progress in science, when the phenomena already known are brought by it into a point of view leading to new essays to prove or to disprove them, then I hope by my efforts to have made an advance, though but small, in that branch which you, the discoverer of diamagnetism have opened.

I could not be entirely satisfied by that theoretical contemplation of the nature of diamagnetism which you, and after you Messrs. Reich, Pogvendorff, Weber, and Plücker have entertained.* This theory requires the hypothesis, that in every molecule of a magnetic substance subject to external induction the magnetism is so distributed, that to the inducing south pole is directed an induced north pole, and to the inducing north pole an induced south pole; but that in diamagnetic substances the distribution takes place in such a manner, that in every molecule, to the inducing south pole an induced south pole, and to the inducing north pole an induced north pole is directed; or what is the same thing, that the currents of the theory of Ampèere in magnetic substances are in the contrary direction to those in diamagnetic substances. I tried rather to explain to myself the phenomena by an hypothesis which M. van Recs† had advanced; consequently I suppose that in magnetic, as in diamagnetic substances, the polarity of the molecules have the same direction; so that all the north poles are turned to the south pole, and all the south poles to the north pole of the inducing magnet; only with this difference, that in a bar of *magnetic* substance the *intensity* of the distribution upon the molecules *increases* from the ends to the middle, while in a bar of *diamagnetic* substance it *decreases* from the ends to the middle. The currents of Ampère in magnetic substances would be consequently more feebly directed in a given particle than in those nearer the centre of the excitation, but stronger than in those more distant; but in diamagnetic substances the reverse would be the case.

These suppositions are permitted, if we attribute to the two groups of substances a diverse resistance to the magnetic excitation (a different *coercive power*). The particles of a magnetic body have a very feeble coercive power: then the distribution of magnetism must take place in such a manner, that the magnetism evolved in every particle by the primitive excitation acts on its part on the others, and particularly on

* *Quarterly Journal of the Chemical Society*, January 1, 1851.

* I have not adopted the view referred to. See *Phil. Trans.* 1850, p. 171.—M. F.

† *Memoirs of the Netherlands Institution*, vol. xii.

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the neighboring particles. Because the molecules are situated very near one to the other, it may be supposed that this part of magnetism is stronger than that of the primitive excitation. But in diamagnetic bodies the coercive power is so considerable, that this portion of magnetism which appears by the excitation of the molecules one on the other is more feeble than that which is produced by the primitive excitation.

A bar of magnetic or diamagnetic substance may be excited in two manners; either from the ends to the centre, or from the centre to the ends.

A. The excitation from the ends to the centre is done when a bar is suspended between two magnet poles.

1. When the coercive power is such that the effect of the molecules on each other may be neglected, then every particle that is nearer to the magnet pole will be more strongly excited than the neighboring and more distant particle.

If we observe two such neighboring particles near the external south pole, then will the more near repel a south pole with the intensity s; the more distant will turn to a north pole with the intensity n', but in such a manner that $n' < s$. But outwardly these two excited magnetisms act with the difference of their power $s - n'$; but this in our case *south polar*, consequently of the same kind as the exciting south pole. The contrary will take place near the north pole, so that *the disengaged magnetism, distributed over the bar, becomes south polar on that half which is turned to the south pole, but north polar on the other half that is turned to the north pole.* A substance, where this takes place, is *diamagnetic*, it places itself equatorial.

2. When the bar of a magnetic substance is so qualified that the separating action of the molecules on each other must be taken into consideration, then it can become so strong that the molecules in the middle of the substance are more strongly magnetic than at the ends. If we observe, once more, two such particles near the external south pole, the south pole of the nearest will tend to recede by an intensity s_1 from this external south pole, but the more distant will turn towards it a north pole of the intensity n_1', but in such a manner that $n_1' < s_1$. Outwardly the two will act with the intensity $n_1' - s_1$, but this is north polar, therefore of a contrary nature to the exciting south pole. The contrary will take place near the north pole, so that *the disengaged magnetism distributed over the bar becomes north polar on the half that is turned towards the south pole, but south polar on that half that is turned towards the north pole.* A substance where this takes place is *magnetic*, it places itself *axial*.

3. Besides, of this observed disengaged magnetism, we must further consider that portion which becomes disengaged on the final surface of the bar, and which cannot be compensated by the neighbouring particles. This is always of a contrary nature to the neighbouring exciting pole. In magnetic bodies it supports the effect of the disengaged magnetism developed in the bar; in diamagnetic bodies it acts in the contrary direction, and it is to be thought that sometimes it even is preponderating. Perhaps this might be the cause of the feeble magnetism that you observed in platinum, palladium and osmium.

B. An excitation from the middle to the ends occurs if we place a bar in an electrical spiral; but in this case all the substances must gain the same polarity as the iron.

To prove that, I placed a thick bar of bismuth in a very strongly acting spiral, which was excited by four cells of Mr. Grove, every one of 12 square inch of platinum plate. I set this spiral on one side, and near to a little declination-needle suspended by a silk thread, and I compensated its effect by a steel magnet which I adjusted on the other side of the needle till the latter was returned to its first place. When I withdrew the bismuth bar out of the spiral, then the needle declined in favor of the compensating magnet; but if I restored it again in the spiral, then the needle declined in favor of the spiral. Unfortunately the poverty of the physical establishment of our university did not allow me to test other substances than the bismuth, but I shall supply this defect as soon as it is to be done. You will allow me the consequence —that diamagnetism and magnetism are only modifications of the same power, which are produced partly by the coercive power of the substances, partly by the different manner of excitation.

Applying the former to the theory of Ampère, I was startled, because it has hitherto taught only that currents which are parallel and directed in the same way attract, but if they are parallel, and not directed in the same manner, they are repulsive; therefore, that a current, moving in the direction of the hand of a watch, in a spiral produces a south pole on the entrance point in the spiral, but a north pole on the egression point. Hitherto, only such spirals have been constructed in which the current in every winding shows an equal intensity.

But I tried to arrange spirals of the following kind:—One of them is in such a

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way constructed, that on two copper wires are soldered to each of them fifteen thin wires covered over with silk. The first winding backwards over the copper wire, *i. e.* the first convolutions of the helices, beginning at the end and proceeding towards the centre, is with all the fifteen wires; the second winding is only wound with fourteen threads, whilst the fifteenth is carried along the axis, &c., consequently every convolution of the fifteen windings has a thread less, and the ends of all the other threads have the direction of the axis. The ends of the fifteen threads are soldered in the middle, and the two thick wires, without touching each other, are so bent, that they can be suspended in the little cups of the apparatus of Ampère; then a current, passing through the spiral, will divide itself in such a manner that it is most strong on the external ends of the spiral, but decreases more and more to the middle. If the winding of the spiral took place in the direction of the hand of a watch, then the end of it, where the current enters, will become a south pole; *but a north pole* kept parallel to the spiral *will repel it*. Only the final convolution will be attracted, and it represents the disengaged magnetism of the final surface.

A second spiral is wound like that described, only with this difference, that the strongest convolutions are in the middle, and the weakest near the ends. This spiral will be attracted by the north pole of a magnet over the half in which the current moves at first, or enters, but the other half will be repulsed by it. The third spiral has the windings the same strength over the whole extent: it is indifferent to a magnet pole, which is not too near, and only the final convolutions are attracted or repulsed.

Therefore it is permitted to enlarge the theory of Ampère in this manner:—

If an electric current passes through a spiral in the direction of the hand of a watch, and

a. If the current is more feeble in every winding, as it is nearer to the centre of the spiral, then that half is attracted by a south pole, in which the current enters, except the first winding;

b. But if the current is stronger in every winding, as it is nearer to the centre of the spiral, then that half is repulsed by a south pole, in which the current enters, including the first winding.

The contrary will be the case for that half in which the current leaves the helix, and likewise for the north pole of the magnet opposed.

With this extension of the theory of Ampère, it is easy to apply it to the views above brought forward. In the molecules of magnetic and diamagnetic bodies are electric currents. By the magnetism they will be in such a way directed, that they put themselves parallel to the external acting currents. In the diamagnetic bodies a very great resistance is opposed to the direction of these currents of the molecules, therefore their intensity will decrease from the centre of the excitation. These bodies will comply with the opinion that is given in *a*, they will be repulsed. But in magnetic bodies the currents of the molecules that are directed by external influence act on their part, also directing the currents of neighbouring molecules, and in such a manner that these currents are the more energetic in the middle of the bar, but more feeble near the ends. These bodies comply with the view given in *b*; they will be attracted and place themselves axial.

But I fear I should tire you were I to apply the views I have brought forward to the different phænomena that followed your discovery of diamagnetism. The phænomena of mingled magnetic and diamagnetic substances; the predominating attraction or repulsion of the axis of crystals; the phænomena of the magne-crystallic axis; the currents of induction that a bar of bismuth gives, as shown by M. Weber;—all these consequences follow of themselves in a very simple manner.

I have the honor to be, Sir,
Your most humble Servant,
Dr. VON FEILITZSCH,
Professor in the University of Griefswald.

ON THE CHEMICAL EQUIVALENT OF MAGNESIUM.*

BY MM. R. F. MARCHAND AND TH. SCHERER.

THE uncertainty which, notwithstanding the numerous investigations made to determine it, still exists with regard to the true chemical equivalent of magnesium, led the authors to undertake new researches on the subject.

The process which these chemists adopted for making this delicate determination consists in estimating the quantity of carbonic acid contained in a given weight of native carbonate of magnesia. The mineral which they chiefly made use of in their experiments was the magnesita of Frankenstein, of which they were enabled to procure some

* *Journal für Praktische Chemie.*

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very pure specimens. The numerous experiments which the authors made show that the selection of the mineral is by no means unimportant. Some magnesite contains very considerable quantities of silica, carbonate of iron, alumina, and especially water, which it is almost impossible to remove by dessiccation, without at the same time disengaging small quantities of carbonic acid.

The magnesite of Frankenstein contains only 0·05 per cent. of foreign substances, for which allowance was made in the calculations. A determined quantity of this mineral, well pulverised, was introduced into a glass tube placed in a stove, the temperature of which could be raised at pleasure. By raising the temperature of this stove to 572° F., at the same time passing through the tube a current of dry air carefully freed from carbonic acid, it was certain to remove all the water which the magnesite might contain; but, at the same time, carbonic acid was disengaged, which it was essential to collect and to estimate. For that purpose, the current of air was directed, on leaving the tube, into two flasks containing perfectly clear baryta water. The carbonate of baryta, collected after the dessiccation, was estimated in the state of sulphate, and the quantity of carbonic acid represented by the weight of the sulphate was added to that which was obtained in the following operation.

The residue which remained in the tube, after being again weighed, was calcined at a powerful red heat. The loss of weight represented almost all the carbonic acid contained in the mineral. The calcined residue still contained traces of it. To determine these, the authors dissolved this residue in hydrochloric acid, and passed through the heated solution a current of air which removed some traces of carbonic acid, and deposited them in a perfectly clear solution of baryta. Thus, the total quantity of carbonic acid contained in a given quantity of magnesite is composed:—1, of the portion removed by dessication at 572° F.; 2, of the portion driven off by calcination; 3, of the small quantity which remains in the calcined residue.

All these experiments were made and discussed with suitable care, and gave sufficiently concordant results. The last eleven determinations which, according to the authors, are most worthy of confidence, gave for the equivalent of magnesium a mean of 250·34 (O=100) or 20 (H=1).

As all the faults committed in such very delicate analyses tend rather to increase than to diminish the real cypher, MM. Marchand and Scherer think that, neglecting the insignificant fraction of thirty-four hundredths, the round number 250 may be adopted as the equivalent of magnesium (O=100) or 20, taking the equivalent of hydrogen as unity.

According to this:—

100 parts of magnesium contain 40 oxygen and 60 magnesium.

100 parts of carbonate of magnesa contains 47·619 carb. acid and 52·381 magnesia,

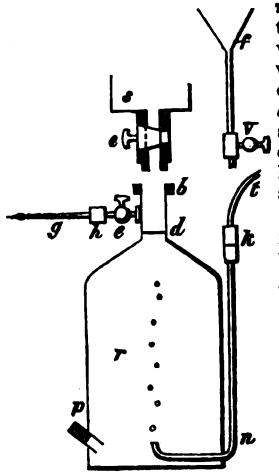
100 parts of sulphate of magnesia contain 66·667 sulph. acid and 33·333 magnesia.

The researches of MM. Marchand and Scherer place magnesium in the number of those simple bodies, whose equivalents are multiples, by an entire number, of the equivalent of hydrogen.

AN IMPROVED GAS HOLDER AND OXYHYDROGEN BLOW-PIPE.*

BY T. TATE.

THE following economical apparatus, answering the double purpose of a gas holder and an oxyhydrogen blow-pipe, has been successfully used, for some time, by the writer of this paper. In the annexed cut,



r represents the gas receiver; *s* a shelf which screws on at *b*; *e* and *e* stop-cocks, as in the ordinary gas holder; *h g*, a jet filled with wire-gauze at the thick part, *h*; *p*, an aperture for receiving the beak of a retort; *n k*, a bent pipe passing into the interior of the receiver, *r*; *kt*, a flexible tube, which screws on at *k*, and forms a connection with a bladder containing the mixed gases; *f*, a funnel with a tube and stop-cock for screwing on at *k*. The tubular portion, *d b*, is about ¾ inch internal diameter, and 2 in. in length. When the apparatus is to be used as an oxyhydrogen blow-pipe, water is introduced into the receiver, so as to stand at the level *d*; the orifice at *b* is closed by means of a

* From *The Builder*.

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cork, and the bladder containing the mixed gases is screwed on at *k*; the safety-jet, *hg*, is screwed on the stop-cock *e*: upon pressure being applied to the bladder, the mixed gases rise through the water, and filling the space *d b*, pass out in a strong stream through the jet *g*, and are there ignited. This arrangement is perfectly safe, for in the event of the flame passing along the safety-tube *h*, we can only have an explosion of the gases contained in *d b*, the only effect of which would be to blow out the cork in the orifice *b*, as the large body of water in *r* most effectually cuts off all communication with the gases in the bladder. When the apparatus is to be used as a gas holder, the shelf, *s*, is screwed on at *b*, the funnel, *f*, at *k*, and the gases are received and transmitted in the same manner as in the ordinary gas holder.

ON THE MEANS OF ESTIMATING THE TARTAR CONTAINED IN WINES.*

THE determination of the proportion of tartar contained in red and white wines is a very important operation, and one which we are frequently called upon to perform.

The means generally used consist in evaporating a known quantity of the wine to the consistence of a soft extract, treating it by alcohol at 82°, and then separating the insoluble extract, which is received upon a paper filter and washed until the alcohol passes through colorless; this residue consists of crude tartar, mixed with a little extractive matter and some calcareous salt. Calcine it in a platinum crucible to decompose the tartaric acid of the tartar, and transform this latter salt into carbonate of potassa, the proportion of which may be estimated by the alkalimetrical method.

Experiment has proved to us that a gramme of *pure and crystallised bitartrate of potassa*, decomposed* by heat in the above-mentioned conditions, furnishes a carbonaceous residue, which, dissolved in hot distilled water, gives an alkaline liquor requiring for its complete saturation 9cc 75 of a weak solution of sulphuric acid prepared with 100 grammes of sulphuric acid at 1·842 of density, and 1800 grammes of distilled water.

If we can operate only on less than a decilitre of wine, it is preferable to act with a more dilute liquor, which is to be prepared by diluting the above with an equal volume of distilled water; this will then be at 19 cc. 50 or 1950 cubic millimeters to saturate the carbonate of potassa proceeding from the calcination of a gramme of pure bitartrate of potassa.

A burette, with a bent neck, holding from 20 to 25 cubic centimetres, accurately graduated, will suffice to render these operations simple and exact.

* *Journal de Chimie Médicale*, Jan. 1851.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE ACTION OF SAL AMMONIAC IN THE OXIDATION OF COLORING MATTERS BY THE SALTS OF COPPER.*

BY MM. C. KŒCHLIN AND E. MATTHIEU PLESSY.

HYDROCHLORATE of ammonia assists greatly in the oxidation of coloring matters by the oxy-salts of copper; it is found in conjunction with these salts in most of the applied colors.

The experiments which we are about to describe will enable us to demonstrate the theory of this reaction.

When a plate of copper is plunged into a solution of acetate of copper out of contact with the air, there is, as is well known, no reaction. But if there be added to this solution hydrochlorate of ammonia (double the weight of the salt of copper), then the liquor is spontaneously decolored.* By cooling, it precipitates in small white crystals, which have all the characters of protochloride of copper. If we now remove the plate of copper and agitate the solution in the air, it will resume its primitive color, and form itself once more into binoxide of copper.

* *Journal de Pharmacie et de Chimie.*

* A method of estimating copper, founded on this reaction, has been the subject of a note by M. Levol.

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A little reflection on this experiment will enable us easily to see what is the function of the sal ammoniac when employed in conjunction with a salt of copper in the presence of a colorable organic principle. This principle evidently takes the place of the metal in the experiment which we have just described. It reduces the oxide of copper. But, on tissues, the reaction, in favorable circumstances, in humid air, does not cease there; after a first reduction, there remains a compound which, by the property it possesses of absorbing oxygen, is capable of furnishing a new aliment to the oxidation, or colorable principle. The advantage arising from the use of sal ammoniac is easily understood, when it is requisite to use, with a matter requiring a great amount of oxidising agents, but little oxide of copper, to avoid a coloration unfavorable to the lake deposited on the tissue. This is the case with the roses of Sainte-Marthe. Very little cupreous salt is introduced into these roses, which is rendered sufficient by the presence of hydrochlorate of ammonia, after a suitable exposure to humid air.

In this case, must we not admit that the oxide of copper acts as a means of continually transporting the oxygen of the air on to the colorable principle of the Sainte-Marthe? What appears to confirm this hypothesis is, that a red left unwashed for several weeks when once it has attained its maximum of coloration, degenerates into a pale brown, passing successively through more and more burnt tints.*

Notwithstanding the advantage in oxidising with less quantities of the cupreous salt, afforded by the use of sal ammoniac, the employment of this salt is not free from inconvenience in certain cases of vapor colors, where it may cause too powerful an oxidation, although used in extremely small quantity.

According to the above, if the cupreous compound, the product of the reduction of the cupreous salt in the presence of sal ammoniac and of a plate of copper, absorbs the oxygen of the air, this compound may, like the binoxide, be adapted to the oxidation of a coloring matter. This is, in fact, what we have observed.

250 grammes of sulphate of copper, and 375 grammes of sal ammoniac, were dissolved in sufficient water to make a quart of solution. A portion of this solution was reduced by copper chippings. The rest was reserved in *statu quo*. On the other hand was prepared a color of catechu of 200 grammes to the quart, properly thickened. Into equal volumes of color (two pints) were poured a decilitre of each solution of copper. It was immediately printed and steamed after a proper exposure to the air. After steaming, we observed the effect which we expected. The oxidation had advanced farthest on the portion *reduced*. This will not be surprising if we consider, according to what has been already mentioned, that the dissolved oxide of copper having to furnish the oxygen, either alone or by the aid of the air, the oxidation of the coloring matter should proceed quickest where there is the most metal, the oxygen being in the same proportion in the salt of copper, and this is what occurs in our solution of copper when the metal has been introduced. The copper is dissolved, but nothing else is changed in the absence of air; but, when air intervenes, a quantity of binoxide of copper is formed, double what was dissolved, and capable of furnishing double the amount of oxygen, according to the formula:—

$CuO^2 + Cu = Cu^2O^2$, which, in the presence of $+O^2$, become Cu^2O^4.

The principal characteristic of the mixture of a salt of copper with sal ammoniac, for our purpose, may thus be seen. This characteristic is, giving an easy oxidation to a colorable principle. But, if it is proved that hydrochlorate of ammonia developes an oxidising power in a salt of copper, it is as yet unknown whether any other salt of ammonia would not produce an analogous effect. The following experiment has enabled us to determine this.

To equal quantities of caustic ammonia, saturated by different acids, were added an equal volume of a normal solution of catechu, containing one-fourth of the weight of the coloring matter of sulphate of copper.

For the sake of distinctness, we will designate the acids on which we operated by numbers; these numbers will afterwards indicate the colors produced by printing:—

1—Hydrochloric acid		In a given volume of caustic ammonia.
2—Nitric	,,	
3—Acetic	,,	
4—Sulphuric	,,	
5—Oxalic	,,	
6—Tartaric	,,	
7—Citric	,,	

These different salts of ammonia were introduced into the normal solution of catechu. One volume of this solution was left as it was, to see what the salt of copper would do, in the oxidation of the coloring matter.

* Certain ferruginous colors present a similar spontaneous combustion; thus we sometimes see an intense campeachy black become in time of a pale brown, although kept sheltered from atmospheric influences.

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As this was a comparative experiment, we operated so as to have always equal volumes of coloring matter before us. As for the salt of copper, that is always in equal proportion, because it enters into the composition of the normal solution of catechu, of which we always took the same quantity.

The color which contained no salt of ammonia, where salt of copper alone was employed, was marked by the sign 0.

After printing, they were left in the air for some days, and we then remarked that the colors 0, 4, 5, 6, 7, were of equal intensity; the numbers 2, 3, were darker than the preceding, and, finally, number 1, relatively to numbers 2, 3, and consequently in comparison with the others, presented a considerable developement in the intensity of the color. We may thence conclude that in number 1 there was oxidation; that in numbers 2, 3, the evaporation of a volatile acid, rather than oxidation, appeared to have raised the tone of the color; and in all the others, 0, 4, 5, &c., there was no change.

These are our observations on colors exposed to the air. These colors were steamed, and the same differences were observable: number 1, that is the color containing hydrochlorate of ammonia, was likewise much the darkest.

Thus, then, hydrochlorate of ammonia is the only salt of ammonia, which acts in a powerful manner in the oxidation of the coloring matter. On the other hand, we have already mentioned that in the presence of metallic copper and of a salt of copper, it renders easy the reduction of the salt. In comparing these two facts, we were led to a comparative examination of the influence of sal ammoniac and that of our ammoniacal solutions 2, 3, 4, 5, &c., on the reduction of a salt of copper by metallic copper, and we have proved that, in all these solutions, none have presented the reaction observed in the sal ammoniac. This salt offers in this respect a peculiarity which has some value for us, as justifying the parallel which we have established between a reducing metal and a colorable principle. For it may here be remarked that we have two series, one with the metal, the other with a colorable principle, and that, all other things being equal, the results accord and demonstrate that the action of the sal ammoniac is quite peculiar, and besides that this action, in presence of a reducing body, whether metal or colorable principle, is exercised in the same manner.

Now that it is possible, from the preceding facts, to form an opinion as to the action of sal ammoniac on a salt of copper, it appears clear that the ammonia exercises no influence on this action; we have therefore asked ourselves whether any other chloride, common salt, for example, might not produce an analogous effect to that obtained with sal ammoniac.

This question has been answered in the affirmative by the following experiment:—To the normal catechu already mentioned was added, on the one hand, chloride of sodium, and, on the other, hydrochlorate of ammonia. Except the reflection of the tint, which was the sole difference, the results appeared to us alike, so far as regarded the oxidation, which was certainly as far advanced in the one case as in the other.

The experiment which we have just described indicates in a precise manner what sal ammoniac can do where a color contains a salt of copper; it undoubtedly acts like any other chloride, by producing a double decomposition, from which results the bichloride of copper. When once this salt is produced, the hydrochlorate of ammonia is of no further use during the progress of the oxidation of the coloring matter. Thus we had imagined that the property possessed by the protochloride of copper of dissolving in water charged with sal ammoniac, might establish a sensible difference between this salt and chloride of sodium, but our experiments on this subject prove nothing of the kind. Chloride of sodium acts like hydrochlorate of ammonia, and thus the action of this last salt is to us clearly defined; it can have but one purpose, the production of bichloride of copper, which, better than any other salt of copper, aids in the oxidation of a coloring matter. The following experiment is convincing on this point:—

When, into two equal quantities of a thickened solution of catechu, is introduced, to the one, bichloride of copper, and to the other, sulphate, and it is remarked by simple exposure to the air, but better after steaming, that when the chloride of copper has been used, the color is considerably developed, that then only the oxidation has taken place.

In fact, hydrochlorate of ammonia in the colors, in which it is employed, is, in our opinion, intended to produce a double decomposition, from which results bichloride of copper, whose oxidising action on these coloring matters is peculiarly energetic, and it is precisely this which appears to us to justify the use made of this salt.

Any other chlorides, the chlorides of sodium, potassium, calcium, tin, &c., may be substituted for hydrochlorate of ammonia.

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NOTE ON THE PRECEDING ARTICLE.

BY M. H. SCHLUMBERGER.*

M. H. SCHLUMBERGER has repeated the foregoing observations, and from his own experiments, and those of MM. C. Kœchlin and Plessy, he has deduced the following conclusions, namely :—

1st. That the action of hydrochlorate of ammonia, mixed with salts of copper, is intended to produce double salts, which have the property of oxidising the colorable matters and, besides, of decomposing and yielding the cupreous oxide to the modified or oxidised coloring matter, which is fixed, in this state, on the cotton tissue.

2nd. That the hydrochlorate of ammonia cannot be replaced by any other chloride, in fixing and oxidising the coloring matters by the salts of copper.

3rd. That these facts are confirmed as regards the coloring matter of Lima wood and campeachy wood, as well as catechu.

4th. That the chloride of copper and nitrate of copper, used in large proportions, equally fix and oxidise catechu; but, in this case, the proportion of these salts must be so strong that it is impracticable on a large scale.

5th. That the coloring matter of catechu, *oxidised* and fixed on the goods by the double salts of copper, will give a dark brown color, according to the proportion of the catechu.

6th. That the *non-oxidised* portion of the catechu may likewise be fixed on the tissue, in combination with oxide of copper; but it produces different and paler colors than in the preceding cases of oxidation.

7th. Finally, the catechu cannot be fixed on the cotton tissue without the intervention of a mordant, such as oxide of copper, oxide of chrome, oxide of iron, oxide of manganese, oxide of tin, alumina, lime, &c., &c.

CHEMISTRY OF MADDER.†

WE have seen a number of articles in exchange papers relative to the cultivation of madder in America. We have heard that a considerable quantity of madder is raised every year in Ohio, but we do not know how much. There can be no doubt but it can be grown profitably in many of our states. Madder is a dye drug and paint (in the form of a lake), and has long been known and used for these purposes. Madder root grows on light soils, and is reaped every three years in France, and every five in Turkey. The roots are dried in the open air or in stoves, and then either ground or merely deprived of their dirt: fibres, &c., by rubbing and winnowing. When the roots are ground they bear the name of madder; when they are in their entire state they are called Turkey roots. The coloring principles are not diffused throughout the root, but are found between the outside root and the middle fibrous parts. It is grown in various countries, Turkey, France, Holland, &c. Dutch madders, although inferior to French for red or pink dying, are nevertheless good for chocolate or purples; they are generally recognised by being coarser ground than the French. Dutch madder improves in quality by being kept two or three years; after that time it gradually loses its properties. Madder, when kept for a long time in casks, ferments, and sometimes increases sufficient in bulk to burst them; and it becomes so hard by long keeping that it is necessary to have recourse to a pickaxe to remove it from them. One hundred parts of madder root gives, on an average, about twenty parts of madder. Boiling water does not dissolve all the coloring matter of madder, a certain amount remaining fixed; but alcohol removes nearly all the coloring matter. It was formerly believed, that there were three coloring principles in madder; the red, alizarine; the purple, purpurine; and the yellow, zanthine. In 1837, a French botanist discovered, by microscopical investigation, that there is but one coloring principle in madder, which is yellow, and that the other colors are produced by oxidation of this yellow principle. M. Girardin afterwards confirmed this statement by chemical investigations. Alizarine is the red coloring substance, and the important one. It crystallises in fine needles slightly soluble in cold and boiling water, and is freely soluble in alcohol, ether, and the alkalis; it communicates to the latter solutions a splendid purple color, which can be removed by precipitating it, unchanged, with an acid. Rubiacine, which is identical with the purpurine of Robiquent, and with the pink of Persoz, does not communicate any color to mordanted cloth. Rubian, the bitter principle of madder, is volatile, and does not crystallise. Xanthine, the yellow coloring substance, is very soluble in water, and, gradually oxidised, it becomes brown; and it is this coloring principle which, by imparting a dirty brown color to non-mordanted cloth when boiled with madder, and which, by spoiling the fixed colors, becomes the chief cause why dyed goods undergo so many processes of clearing before the white parts, and the colors fixed on them, are sufficiently clear to bring them to the state

* *Journal de Pharmacie et de Chimie.*
† *Scientific American.*

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required for the market. Pectic acid is the acid which plays a great part in dyeing with madders, for, if in excess, it removes a part of the mordant, and thus it injures the colors, on account of which it is often necessary to neutralise it in the dye baths by adding chalk; this is to be done with some species of madder, for all do not require chalk, seeing that they already contain a sufficient amount in their roots. A good quality of madder gives nine per cent., a middling quality about twelve per cent. of residue; if a much larger amount is obtained, it is a sign of adulteration. The way to try madder is to test that suspected to be adulterated, with one of a known quality. Of each of these a given quantity is taken, and put into equal bulks of water, together with equal weights of mordanted cloth; thus, for example, 150 grains of each madder is put into one pint of water, with a hank of yarn or strip of cotton cloth weighing 80 grains; the temperature of the water is gradually raised, during two hours, to the boiling point, when the whole is then boiled for ten minutes. The tents are taken out, washed in cold water soaped once or twice (with or without muriate of tin), washed, dried, and compared. Within a few years, a substance produced from madder, termed garancine, has come into somewhat extensive use in calico madder printing. Two French chemists, MM. Robiquet and Caventou, were the first who manufactured garancine, in 1827. It was regarded for many years as a purely scientific product; but after several successful applications of it in one or two houses, it became generally used as a dyeing matter in 1839, since which time its application in the art of calico printing has extensively increased. Garancine is made by treating madder with sulphuric acid, the washed product of which is garancine. In dyeing Turkey-red, the residue of the madder bath was a dead loss. In some works the refuse was piled up in useless huge banks. This is now no more all loss; it is treated with sulphuric acid in a steam box and garancine is the result. This useful discovery was made by M. Schwartz, a chemist, who secured a patent for its manufacture in France, in 1843. Garancine is an amorphous reddish brown powder, nearly insoluble in cold and boiling water; and although it is also insoluble in acids, it becomes soluble in water if an alkali is present, viz., potassa, lime, chalk, &c. Alum acts rapidly upon garancine, by dissolving the coloring matter. Alcohol, or spirits of wine, by repeated boiling, is capable of dissolving all the coloring matter of garancine; it is made from good madder as follows:—After washing the madder with acidulated water, which dissolves the gum, sugar, xanthine, and pectic acid, the mass is pressed, and one part of the vitriol, diluted with one part of water, should be mixed with it, the temperature not being allowed to rise above from 140° to 170° Fahr., for if it does, some of the coloring matter will be destroyed; the amount of vitriol must vary in accordance with the species of madder employed, as they contain various amounts of alkaline earths; nevertheless, after having kept the mass at the said temperature for several hours, it must be washed with water until nearly all the acid is removed; chalk and carbonate of soda are added to neutralise the last portions of acid, and after being washed, dried, ground, and sifted, it constitutes commercial garancine.

Garancine, or garanceaux, as it is sometimes called, which is made from spent madder, is produced as follows:—The grounds of the liquor from the madder bath are treated with weak sulphuric acid to prevent their fermenting, after which the liquor is drained off, the stuff well pressed, and for every 400 lbs. of it, 50 lbs. of the oil of vitriol is added; these, after being well mixed together, are placed in a double-bottomed lead cistern, the leaden plate of which is perforated with holes, and placed five or six inches from the bottom. A current of steam is introduced between the leaden plate and the bottom, and is passed through the acid mass for two or three hours; then the residue first washed with water, and secondly with water containing a little chalk or carbonate of soda; lastly, it is again washed with water alone, dried, ground, and sifted. Garancine has several advantages over madder in dyeing. First, it does not soil the white parts of the print, and make them of such a dirty brown color as madder,—consequently the dyer has not so many consecutive processes to have recourse to in order to remove the coloration of the white parts, since in dyeing with garacine the whites are very little colored, and it is only necessary to pass the pieces into bran and water, heated to 170° F., to have them perfectly clear. Secondly, a further economy is effected, on account of one part of garacine having as much tinctorial power as about three parts of madder. Lastly, the colors produced by garancine are much brighter than those by madder, the pinks and reds having none of the yellow appearance sometimes to be observed in madder colors, and the chocolate color produced by garancine is far superior to that from madder. Still there is one disad-

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vantage in these colors, which is, that they are not so fast as those of madder, that they cannot withstand the action of boiling soap and water. The quantity of garancine required to dye a piece of cloth varies from one to two pounds and a half, according to the style of pattern to be dyed. The process of dyeing is nearly the same as with madder, the pieces being put into the dye becks when the water is heated to about 100°; the temperature is afterwards gradually raised to 170° for an hour and a half, when the bath is boiled for a few minutes. To finish them, it is only necessary to wash them with hot water, or to heat them in a bath of water and bran to 170°, allowing them to remain in until their white parts are perfectly clear. Although it still remains a disputed question as to the beneficial influence of chalk in dyeing with some kind of madders, the influence of alkalis in the case of garancine is sufficiently marked to prevent any doubts upon the subject, for when it is attempted to dye with alkaline waters, it is impossible to obtain good genuine colors; if, for example, the water contains bicarbonate of lime, it immediately colors those parts which should remain colorless, and the colored parts are inferior. In order to remove the difficulty with the white parts, the cloth has to be subjected to several boilings, &c., which tend not only to injure the cloth, but also the colors fixed upon it. When garancine is well prepared, neutral water is the best to make use of; but when the garancine is acid, a certain amount of chalk must be employed to neutralise the acid. When the water is alkaline, a certain amount of acid can be advantageously made use of. Oxalic acid is the one principally employed, owing to its property of forming with lime an insoluble and inert compound. Madder lakes for painting are generally prepared by first washing the madder to free it from all soluble substances, and then boiling it with alum; caustic potassa or soda is then added with great caution. The coloring matter which combines with the alumina is thus precipitated, which is then carefully washed and dried;—this deposit is the ordinary madder lake.

Madder is used to dye drabs, salmons, and many colors. The above relates principally to its employment in the art of calico printing.

AUTOGRAPHIC INK.*

AUTOGRAPHY consists in writing with an ordinary pen and a particular kind of ink on paper prepared for the purpose, by which means the writing may be transferred to stone, and thus, by a lithographic press, a number of impressions may be taken.

M. CRUZEL'S PROCESS,

which obtained the prize at the Societé d' Encouragement.

This process consists in applying to the surface of the paper a coating of gelatine, on which the writing is made. By moistening the matter with which the paper is covered, it detaches itself so completely, that the sheet, after having been washed, can be again charged with the same substance. The autographic ink is prepared as follows :—

	grammes.
Virgin wax	180
White soap	60
Shellac	60

Lamp black, 3 teaspoonsful.

Melt together the wax and soap, and before the mixture takes fire, add the lamp black, and stir well with a spatula; then allow the mixture to burn for half-a-minute; blow out the flame, and add gradually the shellac, stirring well the whole of the time; place the vessel again over the fire until the mixture again takes fire; extinguish the flame, and run the product into moulds as soon as it has cooled a little.

This preparation is easy to employ, but is not quite so advantageous as the following:

M. MANTOUX'S PROCESS.

	kilogrammes.
Virgin wax	3
Soap	2
Mastic in tears	2½
Tallow	3
Gum lac	4½
Copal	½

First melt the wax, the soap, the tallow, and the gum lac, as in M. Creuzel's process above described, and then throw on the mass by degrees, sixty grammes of flour of sulphur, before each addition of copal; the burning of the sulphur raises the temperature considerably, and easily melts the copal, which then readily mixes with the remainder of the mass. The product thus produced, is dissolved in a sufficient quantity of water to obtain an ink of suitable fluidity. This ink flows readily from the pen, traces the design freely, and offers no difficulty in its employment; as it is not of any color, this may be added, and the addition of a small quantity of asphalte, which is found to be preferable to lamp black, gives a good black color.

* *Patent Journal.*

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Preparation for autographic paper:—

Starch	8 ounces.
Gum arabic	½ ,,
Isinglass	1 drachm.

Mix with river or rain water, applied as above.

M. Steiner prepares his autographic paper with gum sandrach; this is spread over the paper, which should previously have been traced with crayon. The quantity of sandrach must be very small, and should be applied evenly by means of a hare's foot, and finishing it off with a piece of clean soft linen, to remove all the small particles of sandrach.

NOTE ON PHOGRAPHY. ACCELERATIVE MEANS.*

BY M. BLANQUART-EVRARD.

Having learned from an amateur, who has just come from Germany, that a skilful photographist of Munich, M. Laucherer, whitened the sides of his camera obscura to obtain more sensibility in the exposure, I have thought that we might hitherto have been deceived as to the part performed by the refraction of light in the camera. The experiments which I have made have just proved to me, indeed, that the more successful we are in the precautions which we take to prevent the reflection of the light produced by the object-glass in the interior of the box, the more we diminish the photogenic action on the sensitive layer.

Thus, I have not only covered the inside of the camera with white paper, but, moreover, I have whitened the interior of the tube, at the extremities of which are screwed the two object-glasses, and which opticians make black. In these conditions, I obtained, either on the silver plate, on albuminised glass, or on paper the following four results:—

1. Formation of the image in half the time that exposure in the blackened camera would require.

2. Formation of the image by exposure to a light insufficient for obtaining it in the blackened camera.

3. Uniformity in the impregnation; the lights are not lost before the full developement of the parts of the picture placed in the chiar-oscuro.

4. Infinitely less resistance of the colors which reject photographic action, such as red, yellow and green.

Thus, not only are the results better, in an artistic point of view, but also the photogenic power of the object-glasses is doubled by the whitening of the interior of the camera.

It would seem puerile to deduce here the consequences which result from the experiments which I have just detailed to the Academy; the acceleration by light is certainly the most valuable result which could be desired in the state of progress at which photography on silver, glass and paper has arrived.

PREPARATION OF ALBUMINISED GLASSES FOR THE EMPLOYMENT OF THE FLUORIDE.

The fluoride, which gives extreme sensitiveness to the preparation of albuminised glasses is very difficult of employment when the glasses are prepared by the means already described, this body removing the albumen from the glass, and often destroying the result.

The following preparation has not this inconvenience.

The albumen is employed without the admixture of any chemical substance.

The glass to be albuminised is placed in a frame on a stand, carefully levelled, and it is heated by means of a spirit lamp until the heat of the glass can no longer be borne by the hand; this done, pour off the excess of albumen, and heat again, but not sufficiently to coagulate the albumen. The glass is removed from the support, all the excess of albumen is made to run off, and the albuminised face is placed over a vessel containing acetic acid. The bottom of this vessel is gently heated, the vapors of acetic acid coagulate the albumen, which then acquires a milky appearance.

When the effect is complete, it is heated again, but very gently, in order to dry it, and the glass is left to dry in the air.

To iodise the albumen, the glass is steeped in a bath containing 1 part of nitrate of silver, and 25 parts of distilled water; the glass is left to dry vertically on one angle. It is afterwards immersed in another bath, containing 1 part of iodide of potassium, and 25 parts of distilled water; and again left to dry vertically. Glasses thus iodised may be kept for an indefinite period.

When they are prepared for exposure, it is sufficient to dip them into the aceto-nitrate; they are then very sensitive; but if, in the bath in which they are washed after leaving the aceto-nitrate, from 1 to 20 drops of fluoride be added, the sensitiveness is increased in the ratio of the action of the the fluoride. Experiment alone can give the measure requisite for the operation.

* *Comptes Rendus*, No. 26, 23 Oct., 1850.

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NEW METHOD OF PREVENTING THE INCRUSTATIONS IN STEAM BOILERS.*

BY M. SAILLARD.

MODE OE PREPARATION.

Catechu	100	lbs.
Subcarbonate of potassa	50	,,
Subcarbonate of soda..	50	,,
Common resin.....	10	,,
Lime	20	,,
Water	300	,,

1. Boil for twenty minutes the subcarbonate of potassa and soda with the lime and resin, with 200 parts of water; remove the fire, allow the mixture to settle, and draw off the clear liquor.

2. In another boiler, make a decoction of the catechu, in the remainder of the water; after boiling for ten minutes, pass the decoction through a fine hair or silk sieve, and add to it the liquor obtained in the previous process; stir the mixture, and keep it in well-stoppered vessels.

MODE OF APPLICATION.

The boiler having been well cleaned, introduce through the man-hole, as soon as the boiler is half filled water, a quarter of a pound of the resinous double subjaponate of soda and potassa per horse power every six weeks.

The quantity above mentioned should be introduced every six weeks, by means of the feed pipes, when the steam is low.

For marine boilers, introduce 3 pounds of the preparation every four hours into the boiler for every 100 horse power, and blow off once in every eight hours. The blowing off should be performed ten minutes previous to the introduction of the preparation into the boiler.

OIL FOR LUBRICATING MACHINERY.†

M. BOUDET describes an oil which the French call *liard*, used for greasing machinery. It is made by adding one part of caoutchouc, cut into small pieces, to fifty parts of rape oil, and applying heat until the caoutchouc is nearly all dissolved. This oil is more unctuous than most of the oils used for machinery, and is not so much affected by the rapid motion of the parts to which it is applied, or by other influences to which it may be exposed. It remains fluid at temperatures below the freezing point of water, and offers little obstruction to the commencement of motion in the machines.

M. Boudet suggests the following method of determining the proportion of caoutchouc contained in this kind of oil:—A weighed quantity of the oil is saponified with potassa, and the dry soap treated with spirit, which dissolves the soap with the aid of heat, and leaves the caoutchouc. The insoluble residue is washed with water containing a sixth part of spirit.

We believe that this caoutchouc oil was tried on the Great Western Railway, some two or three years since, and was found not to answer the desired object. There may, however, be certain kinds of machinery to which some of our readers may find it advantageously applicable.

ON AN AERO-DENSIMETER.*

BY M. BAUDRIMONT.

M. BAUDRIMONT communicated to the Academy an account of an instrument recently constructed by him for the purpose of measuring the density of the air, by weighing a light body of very large dimensions. With this apparatus, M. Baudrimont has already made 311 weighings of atmospheric air, at different seasons and periods of the day. The result of these experiments leads M. Baudrimont to the conclusion that the air possesses a maximum of density, independent of its temperature, of the pressure to which it is submitted, and of its hygrometric condition. This maximum, which was at about four o'clock in the afternoon, decreased in proportion as the day advanced. He says, "Contrary to all expectation, I have remarked that a storm increases the density of the air considerably. Rain causes a diminution at least half an hour before hand. In order to study these results, the principal part of which were quite unexpected, I have operated on dry air, in order to eliminate that which related to the presence of the vapor of water in the atmosphere, and to simplify the problem. I have thus observed that when an isolated stormy cloud passed the zenith of my apparatus, the density of the air increased considerably."

On the 16th of May, 1849, on the occasion of a violent whirlwind from the west, accompanied by thunder and lightning, *without rain*, the density of the air was increased.

On the 21st of May, on the occasion of a violent west wind, the density of the air was increased.

On the 5th of May, a storm, accompanied rain produced no apparent effect.

* *Patent Journal.* † Ibid.

* *Patent Journal.*

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When the solar light shone directly on the apparatus, inclosed in dry air under a bell glass, the density of the air was considerably increased. In all these cases, the variations in the density of the air were independent of pressure and temperature.

GYPSUM AS A MANURE.*

M. MÉNE read a communication on the results of certain experiments made by him at Vaugirard, with the view of ascertaining the part which gypsum plays in vegetation. According to M. Méne, seed sown in pure gypsum (obtained by the decomposition of chloride of calcium by sulphate of soda), and watered every day with pure water, germinated after a few weeks, as in the ordinary soil; but the progress of the growth of the plants was not in correspondence with the commencement, for they gradually decayed, and in fifteen days after their flowering completely withered.

In a mixture of equal parts of gypsum and marl, the seed germinated better than in gypsum alone, but always less favorably than in ordinary soil. Seed thrown on manure covered with gypsum, not only germinated rapidly, but the plants obtained a most extrordinary development and vigor. A few drops of acid accidentally thrown on the gypsum covering the manure gave rise to an effervescence, which furnished M. Méne with an explanation of what was passing before him. The carbonate of ammonia produced in the layers of dung, volatilised by the action of the sun, became decomposed in its passage through the gypsum, forming carbonate of lime and sulphate of ammonia. Several experiments proved to M. Méne that the results were obtained by these means, and having watered some flower-pots containing dung, in which some grass seed was sown, with sulphuric acid, sulphate of potassa, hydrochloric acid, chloride of manganese, nitric acid, phosphate of soda, acetic acid, sulphate of magnesia, sulphate of iron, and nitrate of soda, he found that the grass developed rapidly, and that fixed ammoniacal salts run off through the bottom of the flower-pots in which the experiments were made. Gypsum, therefore, has not of itself any fertilising quality—it only acquires a fertilising property when it comes in contact with those ammoniacal salts which it is capable of decomposing. It would appear from this that sulphate of lime might be replaced by any other salt possessing the property of retaining ammonia in a fixed state at ordinary temperatures.

* *Patent Journal.*

M. MELSEN'S PROCESS OF REFINING SUGAR.*

THIS process has been tried at Guadaloupe, and a commission appointed by the governor of the island has reported thereon. The commission state that the only advantage possessed by the use of bisulphate of lime, is that of arresting, or at least delaying the fermentation of the cane juice; that its faculty of decolorising the syrup is annihilated by the necessity of employing a large proportion of lime; and that the relative return of sugar from a given quantity of juice, is less than that obtained by the process at present in use. The commission therefore recommend the abandonment of M. Melsen's process.

As the experiments previously made in France and Belgium failed in demonstrating the advantage of the use of bisulphate of lime in the manufacture and refining of beet-root sugar, and as the report of the Guadaloupe commission is against the employment of this salt in the manufacture and refining of cane-sugar, we conclude that the merits of this much vaunted process have been fairly tested, and that its further employment is out of the question.

SUBSTITUTE FOR THE MARINE GLUE.*

AN excellent transparent substance, well adapted to replace the marine glue of Jeffreys for many purposes, particularly where a transparent joint is required, as in the union of pieces of glass, invented by Mr. S. Lenher, of Philadelphia, was exhibited at the monthly meeting of the Franklin Institute (September 8, 1850), and its properties explained. From its transparency, it was suggested by the Chairman, Mr. G. W. Smith, as admirably adapted for the union of the parts of polyzonal lenses and rings. Small glass boxes, for containing microscopic objects, united by it, were shown, and gave much satisfaction. The composition of the cement is as follows:—Caoutchouc 15 grains, chloroform 2 ounces, mastic half an ounce. The two first-named ingredients are to be first mixed; after the gum is dissolved the mastic is added, and the whole allowed to macerate for a week, which is about the time required for the solution of the mastic in the cold. More of the caoutchouc may be added where great elasticity is desirable. The convenience of its application with a brush, cold, recommends it for approval.

* *Patent Journal.*
† *Franklin Journal.*

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THE LAW OF PATENTS.

THE following official orders have just been issued:—"The Attorney-General, with the consent and concurrence of the Solicitor-General, hereby gives notice, that from and after the 15th day of January, 1851,—1. Every outline description and drawing deposited with the Attorney and Solicitor-General, must be signed and dated by the person applying for the patent, or by his agent. 2. Every person who shall have deposited an outline description or drawing of his invention, shall be at liberty, at any time previously to the enrolment of the specification, to cancel any portion of such outline description or drawing, and for this purpose to deposit a fresh outline description or drawing of his invention, omitting the cancelled part. 3. Every person who shall have entered a *caveat* against the granting of any patent, and shall, upon the hearing of his opposition, induce the Attorney or Solicitor-General not to make any report upon the application for the patent, shall deposit with the Attorney or Solicitor-General an outline description or drawing of his invention in respect of which he opposes the granting of the said patent, such outline description or drawing to be approved by the Attorney or Solicitor-General. 4. After the specification shall have been enrolled, any person shall be at liberty, on the production of a certificate of the enrolment, or after two days notice and payment of 1s., to inspect the outline description or drawing so deposited with the Attorney or Solicitor-General, as aforesaid, of the invention in respect of which the specification shall have been so enrolled, as aforesaid; and any person shall be at liberty to obtain an office copy of such outline description or drawing from the office of the Attorney or Solicitor-General, on payment of the accustomed charges.

"JOHN ROMILLY."

THE INVENTORS' AID ASSOCIATION.

WE beg to call the attention of our readers to an advertisement of the Inventors' Aid Association, which appears on the cover of our present number. The want of such an association has long been felt, and we have every reason to believe that it will now be efficiently supplied. We recommend this useful undertaking to the support of our readers. We may probably resume our notice at greater length next month.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in smelting and treating certain metals, and in the construction and manufacture of furnaces and the materials to be used for the same, such furnaces and materials being applicable to the treatment of metals and metallic compounds, and to various other useful purposes of a like nature ALEXANDER PARKES, of Pembrey, Caermarthenshire, experimental chemist. Patent dated June 11, 1850.

Mr. Parkes describes, first, an arrangement of apparatus applicable to furnaces employed for smelting purposes. This consists of an upright hollow iron shaft suitably supported in the centre of a circular furnace, and provided with the necessary wheel gearing for imparting a slow rotary motion. From this shaft extend arms which carry scrapers extending downwards to within an inch of the sole of each floor, so that the revolution of the shaft causes the scrapers to agitate the ore undergoing the process of calcination.

Claim.—The employment of an apparatus moving over a fixed floor, so as to agitate the mass during the process of calcination, and also the use for such purposes of a hollow iron shaft with solid or hollow arms, and provided with holes for the admission of air during the process.

The second improvement specified relates to the extraction of silver from lead ore. Assuming the proportion of silver to be from 100 to 200 oz. to the ton of lead, it is proposed to add to this quantity, while in a state of fusion, about 1 cwt. of zinc; and then, after stirring the whole well together, to reduce the temperature as low as possible without affecting the fluidity of the mass. The zinc abstracts or combines with the silver, and as soon as the mixture begins to set it is to be ladled off; and as this quantity is sufficient to take up 400 to 500 oz., it may be again melted and used in a similar manner. The silver is separated from the zinc by dissolving the latter in sulphuric or muriatic acid, which precipitates the silver in a metallic state. No claim is, however, made to this process.

A third improvement claimed is the combination of sulphate of lime or baryta, or carbonate or caustic lime, with silex or quartzeous materials to be formed into bricks for fire purposes; such bricks or other forms being particularly applicable to

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the construction of furnaces to be employed in the smelting of metals, and for various other useful purposes.

Lastly, Mr. Parkes proposes, when burning anthracite or stone coal, to introduce jets of steam; with reference to which, however, he merely claims the peculiar mode, described of dividing the steam into jets, as calculated to ensure its ready decomposition. The steam he prefers to use is high-pressure steam, which he conveys to the fire-places through pipes parallel to and underneath the bars. The pipes are placed about four inches apart, and are perforated with holes of the thirty-second part of an inch diameter. This arrangement is stated to be particularly applicable to steam boilers and evaporating furnaces generally.

Improvements in the manufacture of soap, and in the preparation of materials to be used for this purpose. WILLIAM JACKSON, of Kingston-upon-Hull, soap-maker, Patent dated June 11, 1850.

The present improvements consist, in the words of the claims—

1. In "washing, for the purpose of purifying, resin in alkaline solutions of potash and soda, for the use of soap-makers."

2. In "charging such washed resin with potash or soda-ash." And

3. In "mixing the washed resin prepared as described with finished soap, in a fluid state, in the frames or any other vessel."

In carrying out the first operation, Mr. Jackson employs a wrought or cast-iron pan about five feet in diameter and three feet deep, set in brickwork, with a fire-place underneath. In the pan is laid a coil of pipe, perforated with small holes, and in communication with a steam boiler, but provided with a tap to regulate and shut off at pleasure the ingress of steam. Previous to lighting the fire, 10 cwt. of resin, broken in pieces or in coarse powder, are placed in the pan, which is also nearly filled with water. Heat is then applied until the resin and water are in a boiling state, when the fire is to be raked out, or its action on the pan prevented by the interposition of a damper. Steam is now admitted, and the liquid, to which about twenty gallons of soap-makers' lees have been added, is kept at a boiling heat for twenty or thirty minutes, after which the resin is allowed to subside, which it generally does in a few minutes; but if it be in excess, then the addition of about 20 lbs. common salt, quickly causes its precipitation, and the water (which will have acquired a dark red color, and a slightly alkaline taste) drawn off. A fresh quantity of lees and water is then introduced, the steam turned on, and the whole again boiled, the operation being repeated four or five times, when the resin will be found on cooling to present the appearance of common yellow resin, and to be rather tough and hard.

In the second operation, the resin after being heated with sufficient alkaline lees to saturate or saponify it, is allowed to cool, and then mixed with potassa or soda ash containing 50 per cent. alkali in the proportion of 20 lb., more or less of soda ash to the 1 cwt. of resin, the whole being well stirred together to effect its complete incorporation.

The third process is effected in a manner similar to that in which water is at present mixed with finished soap in a fluid state, the resin being introduced into the frames or other vessel in the proportion of 3 to 500 lbs. for each ton of soap.

Improvements in filtering water and other liquids. JAMES FORSTER, of Liverpool, merchant. Patent dated June 27, 1850.

The first part of this invention relates to the construction of filters, and the second to various methods of cleansing the same from any impurities which may have either covered their surface or penetrated into the body of the material of which they are composed.

Mr. Forster proposes to make the porous filtering vessel of a spherical shape, the two parts of which it is composed being first hollowed out and then joined together by cement or otherwise. This vessel is placed inside a strong close chamber, to which the liquid is supplied from a main or force pump, the pressure of which forces the liquid through the porous material into the hollow chamber, which is supplied with the tap for drawing it off. The outer chamber has also a tap, through which unfiltered water may be drawn off, and which further admits of this chamber being cleansed when requisite. Mr. Forster makes no claim to placing a porous filtering vessel within an open tank or cistern, this having been previously done, but states that this part of his invention consists in combining a porous vessel with an external close vessel, and suitable taps or outlets, so that the filtration and discharge of the liquid may be effected by the pressure of the fluid itself. One filtering vessel only is described as being placed within the close chamber; but for water-works, it is recommended to have several filtering vessels to each closed chamber.

When the porosity of the filtering medium is affected by the presence of alu-

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minous earth or clay, the filter is to be immersed for from five to fifteen minutes in a hot solution composed of two fluid ounces of sulphuric acid, and a quarter of an ounce of nitrate of potash to a pint of water. The clay will be thus dissolved, and may be removed by washing with water. 2. If lime, or its carbonate in the state of chalk, be the obstructing agent, it may be removed by the use of a solution of hydrochloric acid in water at the ordinary temperature. 3. In the case of oxide or carbonate of iron, muriatic acid and water, at the ordinary temperature, is recommended to be used. 4. Any oxide of lead may be dissolved by means of nitric acid in the proportion of three ounces to the pint of water. This mixture is to be used at a little above the ordinary temperature. 5. Concentrated sulphuric acid in a hot state is recommended for removing any carbonaceous or peaty matter. And 6. If the obstruction is caused by any oily or fatty matters, a strong solution of soda or potassa in boiling water will have the effect of saponifying the fat, and rendering it easily removable by the use of boiling water.

Mr. Forster states that he does not intend to confine himself to the chemical bodies above specified, as other alkalies and acids may be used with like effects, but he considers them to be the least expensive of any.

Claims.—The application of chemical bodies in solution as solvents for those solid impurities which obstruct the action of filters.

Improvements in refrigerating and freezing. JAMES KINGSFORD, of Essex-street, Strand, Esq. Patent dated July 3, 1850.

The principle of the present improvements seem to consist in causing a current of air, in a state of expansion, to be drawn or exhausted through an air-tight case, and to impinge in its passage against the exterior of vessels containing the water, liquid, or substance to be frozen or cooled. The case is provided with partitions extending nearly across it, and the vessels are so placed as, in connection with them, to form a circuitous passage from end to end of the case. The air is thus caused to act equally against each vessel. When the vapour of ether sulphuret of carbon, or such other volatile spirit is employed in lieu of air, a condenser for reconverting the vapours to their original state is attached to the apparatus.

Claim.—Combining apparatus, as described, for the purposes explained.

Improvements in the preparation and manufacture of caoutchouc or India rubber. ALFRED VINCENT NEWTON, of Chancery-lane, mechanical draughtsman. (A communication). Patent dated July 9, 1850.

This invention consists in combining or compounding with caoutchouc the substances known as gum lac, gum shellac, stick and seed lac, either by grinding or triturating them together, or by means of suitable solvents. The range of proportions specified is from one to eight parts of either of the substances named to one part of the other substance named. The greater the quantity of shellac, the harder, stiffer, and less elastic will be the compound, and *vice versa*. The advantages claimed for this admixture, are that the caotchouc is more economically manufactured and deprived of its unpleasant odor.

It is recommended to sprinkle the surface of thin fabrics made from this compound with finely powdered sulphur, and to expose such articles to the rays of the sun to remove tackiness. The same ingredients is also proposed to be generally introduced in the manufacture of caoutchouc and shellac, either by mechanical or chemical means.

Caoutchouc and shellac dissolved in any suitable solvents, such as camphine, for instance, form a useful cement, which may be further improved by the addition of a small quantity of sulphur.

The vulcanising or curing process, and the admixture of earths, carbonates, and other metallic salts as practised and well understood by manufacturers of India-rubber, is recommended to be adopted in certain cases, as part of the treatment of the substances compounded as above described.

Claim.—The use of gum lac or shellac in its various forms in the preparation and manufacture of caoutchouc or India-rubber, with or without the application of artificial heat, substantially as described.

Methods of imitating ivory and bone. BENJAMIN CHEVERTON, of Camden-street, Camden Town, Middlesex, artist. Patent dated June 19, 1850.

When it is desired to produce imitation ivory, an article of beauty or utility of the desired form, must first be made from solid alabaster, gypsum, or any other native sulphate of lime. For imitation bone, the same material is employed; but it is reduced to powder, and pressed into suitable moulds in a dry state. The subsequent process is in either case the same. The article so moulded or formed is placed in an iron oven, and kept there for forty-eight hours, the heat being gradually raised from 250° to

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350° Fahr. The water naturally contained in such substance is thus expelled, and the articles are rendered opaque, hard, and very brittle. They are then immersed until the surface becomes saturated, in white hard varnish, olive oil, or any other suitable fatty or waxy matter, in a melted state. This stage of the process imparts translucency, and renders the material capable of taking a polish. The last part of the process consists in immersing the article in warm water, if the natural color of the ivory is desired to be retained, but in water impregnated with any suitable dye, or mordant if the articles are to be colored. After undergoing several immersions, the different articles thus manufactured may be placed in a lathe and polished with whiting or putty-powder, as customary.

Mr. Cheverton does not claim alone or together the use of heat to expel from alabaster, gypsum, or any other native sulphate of lime—the water which forms one of their constituent parts—or the use of water or dye to harden and color them after such evaporation; but what he considers to be new and desires to secure is the employment of the varnish, commonly known as white hard varnish, or ordinary olive oil, or any other oleaginous fatty or waxy matter, in a melted or fluid state, in conjunction with the other two stages of his process, whereby the transparency or translucency above stated may be obtained.

Improvements in obtaining certain metals from some compounds containing such metals, and in obtaining other products by the use of certain compounds containing metals. WILLIAM HERBERT GOSSAGE, of Stoke Prior, Worcester, chemist. Patent dated July 17, 1850.

Claims.—1. Obtaining copper and silver, or one of these metals, also sulphate of soda and hydrochloric acid, by the use of the material designated "burnt pyrites," firstly, by fluxing this material with alkali waste, so as to obtain metals in a state of regulus, which is used for decomposing common salt, and thereby obtaining sulphate of soda and hydrochloric acid, at the same time that the copper and silver, when contained in such regulus, are brought to a state capable of solution by water, from which solution these metals, or one of them, can be precipitated in a metallic state, or in the state of oxides and chlorides, which can be easily reduced to the metallic state by many known means; secondly, by mixing such burnt pyrites with common salt and small coal, and subjecting the mixture to the action of sulphurous acid gas, thereby obtaining sulphate of soda and hydrochloric acid at the same time that the copper and silver, when contained in such burnt pyrites, are brought to a state capable of solution by water, from which solution these metals, or one of them, can be precipitated in a metallic state, or in the state of oxides or chlorides, which may be afterwards reduced to the metallic state.

2. Obtaining sulphate of soda and hydrochloric acid from native pyrites, burnt pyrites, and small coal, by making this mixture into balls, which are burnt in kilns, and sulphate of soda and hydrochloric acid produced, at the same time that the copper and silver are brought to a state capable of solution by water, from which solution these metals, or one of them, can be precipitated in a metallic state, or in the state of oxides or chlorides, which may be afterwards reduced to the metallic state.

3. Obtaining sulphate of soda and silver from the regulus of copper and of iron containing silver, by mixing the regulus with common salt and small coal, and making this mixture into balls, which are burnt in kilns, thereby obtaining sulphate of soda, oxide of iron, and a portion of the silver in a soluble state; also extracting the remaining portion of the silver by subjecting the residuum (after lixiviation) to heat, in mixture with coal, thereby converting the oxide of iron to a metallic state, the metallic iron thus obtained being subsequently caused to decompose galena; or, extracting the remaining portion of the silver by subjecting the residuum (after lixiviation) to the action of hydrochloric acid, by which the silver will be obtained in a state of solution, from which solution it may be precipitated in a metallic state, or in the state of oxide or chloride, which can be easily reduced to the metallic state.

PREPARATION OF COLORS FOR PAINTING ON PORCELAIN—USED AT DRESDEN, &c.*

Citron Yellow.—Antimoniate of potassa, 8 parts; oxide of zinc, 2½ parts; lead, glass, or flux, 36 parts (composed of 5 parts of minium, 2 of sand, and 1 of calcined borax melted together). Mix, and introduce into a porcelain crucible placed in a Hessian crucible; fire until the mass assumes a pasty consistence, but no longer.

Clear Yellow.—Antimoniate of potassa, 4 parts; oxide of zinc, 1 part; lead flux, 36 parts (composed of 8 parts of minium,

* *Patent Journal.*

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and 1 of sand) Mix, and fire in a Hessian crucible; the firing may be continued a little longer than the above.

Deep Yellow, No. 1.—Minium, 48 parts; sand, 16 parts; calcined borax, 8 parts; antimoniate of potassa, 16 parts; oxide of zinc, 4 parts, oxide of iron, 5 parts. Mix; fire in a Hessian crucible until the materials are completely mixed, but not longer.

Deep Yellow, No. 2.—Minium, 20 parts; white sand, 2½ parts; antimoniate of potassa, 4½ parts; oxide of iron, 1 part; oxide of zinc, 1 part. Mix; fire in a Hessian crucible somewhat longer than No. 1.

Uranium Yellow.—Oxide of uranium, 1 part; lead flux, composed as last mentioned, 4 parts. Reduce to a fine powder by a muller on a glass plate. This color is employed to give a shade to deep purple or violet.

Uranium Orange.—Oxide of uranium, 2 parts, chloride of silver, 1 part; bismuth flux, 3 parts (composed of 4 parts of oxide of bismuth, and 1 of crystallised boracic acid, fused together; treated as uranium yellow.

Blueish Green.—Chromate of protoxide of mercury, 10 parts; chemically pure oxide of cobalt, in finest powder, 1 part. Fire in a porcelain tube, open at both ends, until the whole of the mercury is expelled. The powder, of a beautiful blueish green, thus obtained, is placed in a porcelain crucible, on which a cover is luted. The crucible thus filled is submitted to the highest heat of a porcelain furnace during one baking operation. A compound of the oxides of chrome and cobalt is thus obtained, in about equivalent proportions:—Chromo-cobaltic oxide, 1 part; oxide of zinc, ½ part; lead flux, composed of 2 parts of minium, 1 of sand, and 1 of calcined borax, 5 parts. Grind fine with a muller on a glass plate. By mixing 1 of this with citron yellow, all the intermediate tints may be obtained—1 of this, and 6 of citron yellow, give a beautiful grass green.

Deep Green.—Treat the chromate of mercury alone in the same manner as when mixed with oxide of cobalt, in the preceding color, and mix one part of the beautiful oxide of chrome thus obtained with 3 parts of the lead flux described in the formula for blue, and rub it down fine on glass.

Green for Shading.—Chromate of mercury, 8 parts; oxide of cobalt, 1 part; mix, place in a flat capsule, and expose to the highest heat of a porcelain furnace during one baking operation. A chromo-cobaltic oxide is thus obtained, of a greenish black color, which, mixed with twice its weight of lead flux, produces a green, useful in shading other colors.

Deep Blue.—Pure oxide of cobalt, 1 part; oxide of zinc, 1 part; lead flux (composed of 2 parts minium, 1 of sand, and 1 of calcined boracic acid), 1 part; lead flux (composed of 2 parts minium, and 1 of sand), 4 parts. Fire in a porcelain crucible for three hours, at least, at a red heat; wash, and rub down fine.

Clear Blue.—Oxide of cobalt, 1 part; oxide of zinc, 2 parts; lead flux as last mentioned, 6 parts; lead flux as first mentioned, 1½ parts. Mix, and fire as for deep blue.

Blue for Shading.—Oxide of cobalt, 10 parts; oxide of zinc, 9 parts; lead flux (2 minium, 1 sand, 1 borax), 25 parts; lead flux (2 minium, 1 sand), 5 parts. Mix, and fire as deep blue. Useful for shading other blue colors.

Sky Blue.—Deep blue, 2 parts; oxide of zinc, 1 part; lead flux (4 mininm and 1 sand), 4 parts. Mix, and rub down fine.

Turquoise Blue.—Pure oxide of cobalt, 3 parts; oxide of zinc, 1 part. Dissolve in sulphuric acid, and add a solution of 40 parts of ammoniacal alum. Evaporate to dryness, and heat the residuum until it is completely deprived of water; then pulverise, and expose to red heat for several hours in a crucible. A combination is thus formed, of about 4 equivalents of alumina, 3 of oxide of cobalt, and 1 of oxide of zinc, of a beautiful turquoise blue color.

Turquoise Blue.—Turquoise blue, as above, 1 part; bismuth flux (composed of 5 parts of oxide of bismuth, and 1 part of crystallised boracic acid), 2 parts. The formula given by Brogniart is not correct.

Iridium Black.—Metallic iridium is mixed with an equal weight of decrepitated common salt, and heated to feeble redness in a porcelain tube, through which a current of chlorine gas is passed. One part of the metal is converted into deuto-chloride of iridium and sodium, which separates by means of water thrown on the ignited mass, from the portion of the iridium which has not been acted upon. The aqueous solution of the double salt, evaporated with carbonate of soda to dryness, then treated with water, leaves a black sesquioxide of iridium, which dried, and mixed with double its weight of flux, composed of 12 parts of minium, 3 of sand, and 1 of calcined borax, is rubbed down fine on glass. The portion of iridium which escaped the action of the salt and the chlorine is then subjected to the same treatment as before.

Iridium Grey.—Sesquioxide of iridium, 1 part; oxide of zinc, 4 parts; lead flux

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(5 of minium, 2 sand, 1 calcined borax), 22 parts, rubbed down fine on glass.

Cobalt and Manganese Black.—Anhydrous sulphate of cobalt, 2 parts; anhydrous sulphate of manganese, 2 parts; saltpetre, 5 parts; mixed and fired at a red heat, in a Hessian crucible, until the decomposition of saltpetre is complete. The calcined mass, boiled in water, leaves an intensely black powder, which is a compound of the oxides of cobalt and manganese. Of this compound, take 1 part; lead flux (5 parts minium, 2 sand, 1 calcined borax), 2½ parts. Rub down fine on glass.

Cobalt and Manganese Grey.—Oxide of cobalt and manganese, above mentioned, 2 parts; oxide of zinc, 1 part; lead flux (5 minium, 2 sand, 1 calcined borax), 9 parts, mixed and rubbed down fine.

Black for Grounds.—Violet blue or gold purple, 5 parts; oxide of cobalt and manganese, 1¾ parts; oxide of zinc, 1¾ parts. Mix intimately, and rub down fine on glass capsule.

White for Covering.—Minium, 1 part; sand, 1 part; crystallized boracic acid, 1 part. Mixed and fused in a porcelain crucible. This preparation has the properties of forming a clear colorless glass, when cooled quickly, as, for instance, when run out of the crucible, and of forming a white and opaque glass, when slowly cooled.

Clear Brown, No. 1.—Anhydrous sulphate of iron, 1 part; anhydrous sulphate of zinc, 4 parts; saltpetre, 13 parts. Fire in a Hessian crucible, until the saltpetre is completely decomposed. Oxide of iron and zinc thus prepared, 2 parts; lead flux (minium, 12 parts, sand 3, and calcined borax, 1), 5 parts.

Clear Brown, No. 2.—Anhydrous sulphate of iron, 2 parts; anhydrous sulphate of zinc, 2 parts; saltpetre, 5 parts. Treat as above, and add flux.

Clear Brown, No. 3.—Anhydrous sulphate of iron, 1 part; anhydrous sulphate of zinc, 2 parts; saltpetre, 4 parts. Proceed as for Nos. 1 and 2.

Bistre Brown, No. 1.—Calcined sulphate of manganese, 1 part; anhydrous sulphate of zinc, 8 parts; anhydrous sulphate of iron, 12 parts; saltpetre, 26 parts. Treat as No. 1, and mix the product with its own weight of flux.

Bistre Brown, No. 2.—Calcined sulphate of manganese, 1 part; anhydrous sulphate of iron, 4 parts; anhydrous sulphate of zinc, 4 parts; saltpetre, 12 parts. Proceed as No. 1. brown bistre.

Sepia Brown, No 1.—Anhydrous sulphate of iron, 1 part; calcined sulphate of manganese, 1 part; anhydrous sulphate of zinc, 2 parts; saltpetre, 5 parts. Treat as clear brown, No. 1, and to the grey brown product obtained add 2½ times its weight of the flux, and rub down fine.

Sepia Brown, No. 2.—Anhydrous sulphate of iron, 1 part; calcined sulphate of manganese, 2 parts; calcined sulphate of zinc, 6 parts, saltpetre, 10 parts. Proceed as sepia brown, No. 1.

Deep Brown, No. 1.—Anhydrous sulphate of cobalt, 1 part; anhydrous sulphate of zinc, 4 parts; anhydrous sulphate of iron, 4 parts, saltpetre, 10 parts. Proceed as No. 1 clear brown, and mix the beautiful deep red brown product obtained with 2½ times its weight of the flux, and rub down fine.

Chrome Brown.—Hydrated oxide of iron, 1 part; chromate of protoxide of mercury, 2 parts; Mix most intimately, and fire at a read heat, in an open muffle, untill all the mercury is driven off. Mix the product with three times its weight of flux (composed of minium, 5 parts, sand, 2, calcined borax, 1), and rub down fine on glass.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SANITARY NOTES.

NO. XI.

As the Parliamentary Session of 1851 approaches its commencement, there is most urgent necessity for activity and vigilance on the part of all sanitary reformers. The ground has been well prepared, and it will be a lasting stain on the English character for plain common sense if there is longer delay in carrying out measures long demanded by the public weal for the safety of life and health. Let not political excitement, let not even the noble contest of human talent and ingenuity in which we are about to engage with the whole world, draw aside all attention from those miseries

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of our fellow-creatures which are in fact caused by legislative and social mismanagement, or from those evils which we have suffered, and have escaped from, but which have been raging with awful intensity amongst our West Indian fellow-subjects—evils which, there as here, might be controlled, and even subjugated by a proper observance of well-known laws of vital economy.

In the last session an act was passed for the regulation of burials. The General Board of Health was constituted the Grand Metropolitan Undertaker, and, in addition to other salaries, £1,200 per annum was granted to one gentleman in special connection with such new duties as the act imposed. Metropolitan graveyards were to be closed, and arrangements were to be made for conveying the dead to a distance from the city. As in the case of the ancient capital of the world, the approaches to the modern metropolis were to be decorated by the suggestive monuments of the past. But, alas for good intentions, whether moral, social, or imaginative! The river banks still retain their verdant hue, and the poor lands bordering on the great railways have yet no chance of reclamation. Three of the worst grave-yards in London are again in use: death and disease again taint the winds that blow across St. Andrew's, Spitalfields, and St. Margaret's fever stills. Other grave-yards are, it is said, also to be re-opened. The Board of Health is silent, for the cholera is not here, though fever is. Cupidity and fancy law, with their "following" of sickness and misery, are paramount over the noble cause of public right, public health, and moral welfare. Shame!

There is some satisfaction, however, in perceiving that (at least among the inhabitants of London) there is stirring a spirit of fierce hostility to the tax on light and air, yclept the window tax. A more infamous tax never disgraced the statute book. To one-half of the inhabitants of a town it is a direct tax on life. Without light and air, neither animal nor vegetable life can exist in a healthy state. To refuse a man sufficient air for the proper functions of his body, is really as great an oppression as the heaviest of those feudal tyrannies from which we alone, of all European nations, have been completely emancipated. As the tax on bricks has been repealed, cheap houses can be built to exclude cold and wet; and if unrestricted power is given with respect to the construction of windows and air-holes, one great step towards the physical amelioration of the condition of the lower classes will have been obtained. But London is not England. The whole country must stir, and then a little gentle pressure will at once obtain a respectful attention to its crying wants.

The common lodging-houses must be brought under police superintendence with fixed regulations, in order that the honest poor may not be made, as now, the victims of brutal cupidity, lust, and crime, and that the dishonest poor may be placed under such surveillance as may tend to check crime in the hotbeds of its fearful vitality. To ensure decent accommodation, sufficient air, and a separation of the unmarried of different sexes in these places, has become a serious duty on the Government, because the feasibility of the work has been proved by private enterprise and philanthropy.

Under the powers of the Public Health Act of 1848, many towns and parishes have been inspected and reported on; but comparatively few have yet taken any active steps for the drainage and water supply, as the estimates submitted have not a little alarmed the ratepayers. It is, indeed, certain that it is more costly to cure evils than to prevent them.

Public attention is attracted now to the Metropolitan Sewers Commission and its doings; and it is not improbable that changes may soon take place. Mismanagement in the business, and either want of principle, or weakness in maintaining it in the works, must be remedied. It is true that a general plan of drainage is in course of execution on the south side of the

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river which will effect great improvement; and a plan for the arrangement of the drainage on the north side of the river has been prepared. But first and foremost amongst the objections to both plans stands the fact that the sewage is to go into the Thames. It is proposed to discharge it at Woolwich or at Erith. In the former case it will certainly find its way back to London; in the latter, it will deal mischief elsewhere. The Commissioners of Sewers are determined that if the Londoners *will not have* the sewage at their doors all the year round, yet they *shall* have it at their places of resort during the hot summer months. This resolution is the more inexcusable seeing that there are ample means of retaining all the volatile and the solid and decomposing part of the sewage by the use of peat charcoal, at a cost which, even supposing the residue to be of no use as manure, but to be simple refuse, would be of far less cost than the actual money value of the diseases which are originated by the exposure of so many broad acres of fermenting filth to the action of the sun's rays. These things must be altered. When misery and distress are staring the farmer in the face unless he can make his land more productive, and disease and wretchedness are caused amongst the town populations by such disposal of that which the farmers want, as amounts to absolute waste, whether it be in London, Manchester, Leeds, or any other town, the country cannot expect any lasting prosperity. If public officers would inscribe in such a manner as to be always before their eyes, the homely motto, which perhaps many of them have inscribed on the walls of their kitchen—"Waste not, Want not"—its principle would be gradually infused into their works, and the land would bloom with more lasting riches, the people would be invigorated by more durable fortune, and light-hearted songs of joy and thankfulness would resound more sweetly from every portion of fair England's bounds.

A sharp and costly contest is in preparation on the subject of water supply to the metropolis. The Board of Health propose to bring water from the sand-hills of the Bagshot district. The water is stated to be of most excellent quality; the method of bringing it, as at present proposed, is novel and probably impracticable, but that is an engineering matter; sanitary requisites will be fulfilled if a sufficiency of good water is introduced by any means. But all the calculations and reports, as to the efficiency of the Bagshot sands to produce water enough for all requirements, have been hitherto based on the assumption that forty million gallons daily is the full extent of an improved supply. This assumption we emphatically declare to be a false one. The quantity estimated by Mr. Warren in his pamphlet noticed in our November number, is much nearer to a fair calculation. Certainly any plan which is incapable of *guaranteeing* to the two and a quarter millions inhabitants of London, with all their factories, &c., an improved supply of fully fifty-five millions gallons daily, will be a bitter mockery.

Whatever the Government proposition may be, however, it will certainly be thoroughly sifted, for all the influence of the existing powerful companies, as well as of several new ones, will be brought forward in opposition to it.

Smithfield will now happily ere long be reckoned amongst the things of the past. Its warmest defenders have abandoned it. Parliamentary interference is now asked for, both by its friends and enemies. But public attention must be alive, lest "one of the grossest physical and moral nuisances ever inflicted on a great metropolis by the irresponsible power of a corporate body of a fraction of that metropolis," should be permitted to re-establish the nuisance in a different form on adjoining ground. The report of the Medical Officer of the City of London, for the year 1850, gives such a fearful view of the sanitary condition of the streets bordering on the river Fleet, into which the new market, and its concomitant

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slaughterhouses would drain, that the question is obviously one for the earnest attention of sanitary reformers.

There is yet another subject affecting the metropolis in a sanitary view, which will this year demand the attention of Parliament, i. e. the arrangement of an efficient Building Act. This subject has been under consideration above two years, and it is now time that some authoritative rules were laid down respecting the arrangements of streets, courts, and small houses—that back to back houses may no longer be permitted—that the entrances to all courts should be as wide as the courts—that there should be no more *cul de sacs*, but in every case a thoroughfare—that the width of streets and courts should never be less than the heights of the houses on either side—that every house should be drained, and should be supplied with privy accommodation—that efficient means should be adopted to prevent the rising of damp from the soil through the walls—that the height of all rooms should never be less than a fixed proportion to their area—with other matters bearing directly or indirectly on the proper ventilation of all dwellings, both singly and collectively. Constructive stability and safety against fire also require their special consideration.

There is a very important act, the provisions of which are applicable to the whole kingdom, which requires revision. The act commonly called the "Nuisances Act," was passed with a special reference to the dangers of a fearful time. A reconsideration of some of its provisions, an alteration of some of its powers, and then the making it a permanent instead of a temporary act, would lead to many sanitary improvements.

Sanitary science, or that which investigates the physically preventive causes of disease, is now accepted as worthy of the deepest attention. As a result of its labours, it calls on its sister sciences of architecture and engineering to aid in the noble work of lessening human misery and prolonging human life. In the accomplishment of the first of these results, the glorious work is commenced of raising the scale of human intellect, and in the attainment of both results man becomes more fitted for the fulfilment of his mission here, and more capable of looking forward to the unutterable joys of an eternal blessedness.

ARISTOTLE AND THEOPHRASTUS.*

BY M. CAP.

(*Concluded from page* 185).

THE second work of Theophrastus, relative to botany, is entitled: Of the Causes of Vegetation. De Causis Plantarum (περὶ αἰτιῶν φυτῶν). This is a real treatise on vegetable physiology, the only one we owe to antiquity, and one of its author's best titles to glory. In this work, it is no longer as a herbalist or physician that Theophrastus studies vegetables, but as a philosopher, as a botanist and as an agriculturist. He is no longer an historian relating facts he has collected from all sources, and with more erudition than criticism; but an accurate observer, a skilful experimentalist, bringing to his researches the sagacity of a true naturalist, and in the consequences which he deduces from them the grasp of a man of genius. Such, indeed, is the penetration with which he searches into the mysteries of the vegetable organism, that he discovers nearly all that it was possible to ascertain without the aid of optical instruments, and the labors of modern botanists have almost always confirmed by new experiments that which the philosopher of Eresos had, in some measure, divined twenty-two centuries previously. A judgment may be formed of it from the brief analysis which we now give of his Treatise on the Causes of Vegetation.

Pursuing the ideas of Aristotle, who perceived a striking analogy between plants and animals, Theophrastus demonstrated that both are subject to the same laws as regards organisation, developement, nutrition and reproduction.

He attributes all the phenomena of the existence of vegetables to the vital force, which is maintained by a just proportion between the heat and moisture of the plant, which he calls the humid radical.

Reproduction takes place by the intimate union of the sexes, of which the flowers are the seat. The pulverulent corpuscles of the male flowers impregnate the female flowers and cause them to bear fruits. The odor of

* *Journal de Pharmacie.*

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these corpuscles is analogous to that of the seminal liquor of animals. He recognised hermaphrodite flowers and unisexual flowers. In the latter, the approach of the sexes and the fecundation are operated by the intermedium of the winds, of insects or waters for aquatic plants. He distinguishes between the flowers, those which are placed above the ovary, from those which are inserted beneath. The double flowers are sterile. In each species of plant, the flowers appear at certain times of the year.

Fruits succeed flowers. Some are fleshy; others are in the form of husks. Certain operations may augment the size of the fruit or hasten its maturity.

The fecundation once operated, the seed represents the vegetable egg. All the elements of the vegetation are contained in the seed. It is in the seed that the germ is nourished, and that the stem and root are formed.

He compares the root to the stomach of animals. He regards it as designed to derive from the earth the elementary juices of the plant, and to elaborate them so as to render them proper for nutrition. The form of roots varies *ad infinitum*, and their presence is indispensable to the life of the vegetable.

Theophrastus distinguishes ascending stems from creeping stems, and seminal leaves from cauliferous leaves. He knew that certain plants have two seminal leaves, and others only one.

The leaves of the stem and branches have various forms. They have two faces, the upper of which is always of a deeper green. Each face is formed of fibres and vessels, arranged on a peculiar net-work, and without communication from one face to the other. It is by means of the leaves that the plant derives from the atmosphere certain materials of its nutrition, that it transpires, and that it is freed from elements that are useless to it.

The bark is analogous to the skin in animals. It is of two kinds: one is the epidermis, which, in herbaceous plants, covers a more or less thick and succulent cellular tissue; the other is the bark, properly so called, which envelopes ligneous vegetables. It elaborates the nutritive juices and contributes powerfully to the regeneration of trees; however, some of them, like the cork, may lose their bark without inconvenience. That of the cherry tree regenerates rapidly; that of the vine is composed of fibres without parenchyma; in the apple and pear tree, it is detached in plates every year.

The general organisation of the plant is composed of capillary fibrous tubes, adapted for the absorption of nutritive juices. These vessels are isolated and cannot be confounded with each other. The fibres have a longitudinal and parallel direction in the pine and the fir: in the cork tree, they traverse in all directions. These fibres extend even to the fruits and flowers. The plant possesses likewise more voluminous vessels, analogous to the veins, which serve to convey the sap and the juices proper for nutrition.

The parenchyma is placed between the fibres and sap vessels. It abounds in the fruit, and in the fleshy organs, but it is also diffused in all parts of the plants.

The wood of high mountains is more compact, harder, and of more use than that of marshy countries. The most solid part of the wood is that which is nearest the pith. This important substance fills up all the interior of the stem. The palm tree is the only one which has none. The pith is formed of parenchyma and moisture. It is the essential organ of vegetable life; that of the gramina and reeds is different from that of trees.

In the last chapter he treats of the diseases affecting vegetables; they are caused by intemperate seasons, the attacks of insects and the action of external agents; time wastes and dries them.

After having described with great accuracy the various parts of plants, he observes that the most essential organs, such as the root, stem, flower, and even the fruit do not belong to all, and that we cannot find in them the distinctive character of the vegetable. In remarking the absence of pith and concentric layers in the palms, and the parallelism of the fibres in the leaves of the gramina, it is evident that he almost perceived the characteristic features which distinguish monocotyledonous from dicotyledonous plants. Finally, he every where threw light on the organisation of vegetables, as well as on their essential functions, and he built up the foundation of a science which modern physiologists have had only to extend and complete.

Is it not astonishing to see so great a number of new facts, so many luminous generalities result from the researches and conceptions of a single man? for, Theophrastus, far from seeking to appropriate to himself the discoveries of his predecessors, gave a history of the botanists and rhizotomists who had preceded him, and scrupulously attributed to each the observations due to him. We must, therefore, regard the philosopher of Eresos as the actual creator of botany; for before him the study of plants had the sole object of their

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application to medicine, and the science, properly so called, did not exist.

Inheriting the doctrines, and, in some measure, the glory of Aristotle, Theophrastus pursued the task bequeathed to him by his master, and brought to the study of the vegetable kingdom the same light that Aristotle had spread in the history of animals. He gave to botany a more happy direction and impulse, showing what it may do for agriculture, the arts, the wants of social life, in a word, he did for that science all it had a right to expect from the efforts of a man of genius, having regard to the period at which he lived and the little assistance he could command.

Theophrastus conceived the design of extending to mineralogy the study of nature, and of thus completing the idea of Aristotle, who wished to make the history of natural bodies the basis of all scientific instruction. The *Treatise on Stones* which he left behind him is only a sketch of this undertaking. This work, although incomplete, constitutes, nevertheless, one of the first documents which we possess concerning the study of mineral species. We have also from this philosopher some treatises relative to physics, medicine, and physiology, scattered fragments which do not enable us to determine whether they are connected with some general doctrine and which have been too often disfigured by the ignorance or awkwardness of commentators.

We have stated what were the titles of Theophrastus as a naturalist; but the idea which so many works give us of such a genius would be incomplete if we did not add some points relative to his other works and his person. A disciple of Plato, and the immediate successor of the chief of the peripatetic school, Theophrastus played at the same time a very eminent part in the history of philosophy. He taught all departments of literature, from grammar and dialectics to metaphysics and poetry.

Time has deprived us of the monuments which would have revealed to us the whole extent and variety of his knowledge and talents. The fragments which remain to us of his book of Characters suffice nevertheless to show all the nobility and elevation of his soul, his spirit of judgment and of tact, the elegance and purity of his style. Applying to all subjects the strictness and lucidity of his methods, he transformed into a science of observation morality which, until his time, had consisted only of precepts and apothegms; he united in his moral considerations the austere philosophy of Socrates and Plato with the atticism of Diogenes and Epicurus, and in his school was educated the ingenious Menander, who, himself, must have served as a model to Terence.

To all the advantages of a profound and universal genius, Theophrastus united others which must have acted powerfully on his contemporaries, and have served to propagate the influence of his school. He was endowed with a brilliant and easy elocution; his manners were amiable, and his simple but accurate reasoning prepared and captivated his hearers. When he had to develope points of any importance, his eloquence rose and carried him along. A pure and sonorous voice, a noble exterior, and a countenance and action full of expression, added powerfully to the effect of his speech, and rapidly conveyed to his audience the light of conviction. It was then that he justified the surname given to him by Aristotle, and which posterity has retained to him, of *orator of divine language*. The portion of his writings now remaining to us still gives an idea of the extent to which he carried the talent of a writer. "Nothing is seen," says Labruyère, "in which ancient taste makes itself better felt, and in which Greek elegance is more brilliant." We can comprehend how much the high theories of science must have gained by being enunciated in such language, and how, by uniting to profundity of views and ideas a style full of grace and euphony, expression and warmth, Theophrastus merited the title which Cicero was pleased to accord to him, of the most elegant and most erudite of philosophers.*

ON THE BEST PREPARATION OF ARSENIC FOR INTERNAL ADMINISTRATION, AND ON THE CHEMICAL COMPOSITION OF FOWLER'S SOLUTION.†

BY LLOYD BULLOCK, ESQ.

DURING several years past, I have from time to time been asked by practitioners, both in town and country, whether no better and more convenient form of arsenic could be recommended for internal administration than the liquor arsenicalis of the Pharmacopœia. It appears to be the opinion of many who employ arsenic, either as an antiperiodic, or against skin diseases, that the officinal preparation is uncertain in its action—what is usually deemed a small dose in some cases acting with violence, whilst, in others, large doses

* Elegantissimus omnium philosophorum et eruditissimus. (Cic. Tuscul., lv., c. ix.)

† *Lancet*.

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produce but little effect. This may doubtless, in a great measure, be referred to peculiarities in the constitution of the patient rather than to differences in the preparation. Nevertheless, the mode of preparing the liquor arsenicalis adopted by all colleges belongs to a period antecedent to the present state of chemistry, which demands, in all cases, precision, and the rejection of every process, either vague in itself, or admitting the possibility of failure to obtain the intended result. In the instance of the solution of a metallic salt, the maintenance of a certain standard strength being always the desired object, it is certainly always desirable, if possible, first to obtain the salt in a crystalline form, and then, being assured of its purity, both by its chemical and physical characters, to dissolve it in an exact amount in the necessary proportion of the menstruum. On this principle I have for several years recommended the employment of the arseniate of soda, a salt which has all the required characters of great solubility, definite form, and the additional pharmaceutic advantage of being readily made into pills, in such a manner as to ensure every pill containing any given fraction of a grain with perfect accuracy. Moreover, it may be kept in a crystalline form, and dissolved readily, as it is required. Of the arseniate of soda I have received reports from a great many practitioners, invariably favorable as to its therapeutic effects.

The use of arseniate of soda in medicine is nothing new. It is the basis of Pearson's solution, which consisted of one grain of arseniate of soda to one ounce of water. What the reasons may be which led to this salt having been hitherto omitted from the Pharmacopœia, I am unaware.

About twelve months ago, my attention was particularly directed to the liquor arsenicalis by a physician, who was dissatisfied with its effect, and, at his suggestion, I was induced to look more closely into this preparation. The directions of the Pharmacopœia for preparing liq. arsenicalis are as follow:—

"Take of arsenious acid, broken into small pieces, carbonate of potassa, of each eighty grains; compound tincture of lavender, five fluid drachms; distilled water, a pint. Boil the arsenious acid and carbonate of potassa with half a pint of the water in a glass vessel until they are dissolved. Add the compound tincture of lavender to the cooled liquor. Lastly, add besides, of distilled water, as much as may be sufficient, that it may accurately fill a pint measure."

I made the following experiment:—

1. Taking 80 grains of arsenious acid in coarse powder, 86 grains of carbonate of potassa, P.L., and 10 ounces of water; I found a perfect solution effected on heating to 212°, with the evolution of only a trace of carbonic acid.

2. The solution was then boiled until it ceased to give off carbonic acid: it required about twenty hours; an equivalent of the carbonate of potassa was decomposed, forming arsenite of potassa, corresponding with the following formula:—

$AsO^3 KO, CO^2, 1\frac{1}{2} HO$ $As O^3 KO, CO^2, 1\frac{1}{2} HO$
99 : 83·5 : : 80 . : 67·5

It would appear, therefore, that the liquor arsenicalis of the Pharmacopœia is a solution of arsenious acid in carbonate of potassa, with a minute quantity of arsenite of potassa. On looking through all the dispensatories, and commentaries on the Pharmacopœia, I was surprised to find no allusion to this fact. Soubeiran, however, notices it, but no other French writer on Pharmacy subsequent to Soubeiran, that I am aware of.

If it be desirable to give arsenious acid with carbonate of potassa, the following process will give a uniform preparation:—Take eighty grains of arsenious acid in coarse powder; eighty grains of carbonate of potassa, P.L., compound tincture of lavender, five fluid drachms; distilled water sufficient to make up twenty ounces. Boil the arsenious acid in fifteen ounces of water until dissolved, remove it from the fire, allow it to cool a few minutes, and add the carbonate of potassa dissolved in four ounces of cold water; when the temperature of the mixture is reduced to 60°, add the compound tincture of lavender; lastly, make up to exactly twenty ounces with distilled water.

It is probable that many gentlemen may wish to prescribe a true arsenite of potassa, a salt they supposed they were exhibiting in the liq. arsenicalis of the Pharmacopœia. To distinguish this salt from Fowler's solution, it may be called liq. potassæ arsenitis neutralis, and instead of sp. lavand. co., a small quantity of a distilled spirit could be used. The liquor potassæ arsenitis neutralis may be prepared by taking 80 grains of arsenious acid, and 67·5 grains of carbonate of potassa, P.L., or 81·6 grains of crystallised bicarbonate of potassa. Boil in ten ounces of water until no more carbonic acid is evolved; when cold, make up to exactly twenty ounces, with distilled water, and, if thought desirable, a small quantity of a distilled spirit.

There appears to be a variety of opinions

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as to the best form of giving arsenic. Mr. Hume and others, vide *London Medical and Physical Journal*, vol. xxiv., would prefer binarseniate of potassa, but I find that this compound, which was admitted into the former edition of the Dublin Pharmacopœia, has been recently omitted.

The binarseniate of potassa is a beautiful salt easily prepared: keeps well, and from its fine crystalline form its purity is easily ascertained. It would be well if some satisfactory reasons were given for the rejection of this salt.

M. Boudin considers a simple solution of arsenious acid in distilled water as the best; whilst Bieto prefers arseniate of ammonia. There is also a solution of arsenic in some repute, known as De Valangin's solution of solvent mineral, which is a solution of arsenious acid in hydrochloric acid.

It appears to me that the weight of testimony is in favor of arseniate of soda. M. Cazenave speaks highly of it; and upon the whole I should say it is probably milder in its action than other forms of arsenic, and, as far as I know, is devoid of objection.

The best method of administering the arseniate of soda is in the form of pills, made up with crumb of bread or some inert powder.

In conclusion, I think I cannot do better than quote Dr. Powell, who, writing on arsenic, observes, "when the dose is small and the effect so powerful, the most minute attention to its proportion and preparation becomes necessary."

POISONING BY PEACH FLOWERS.*

BY M. J. A. BORIOD.

Theodore G—— was a veteran soldier, aged thirty-nine years. Middle size, strong constitution, sanguino-bilious temperament, voracious apppetite, eating all that came within his reach, when he could avoid the most watchful superintendence; of a sombre and taciturn character, giving short and insolent answers, but never complaining of his residence at Maréville.

On the 11th of last April he went as usual to work in the garden. During the morning he eat considerably of all sorts of flowers, principally peach flowers, immediately cephalalgia followed, then epileptiform convulsions and considerable vomitings, composed of food, of peach flowers, and of some entire roots. In the course of twenty minutes, convulsions alternated with the vomitings, the body was cold, the color pale, the features deformed, the pupil dilated, the pulse irregular and almost imperceptible. The patient could not support himself upon his legs; he was in a complete state of prostration or tetanic contraction. Finally he expired towards mid-day in a last and much stronger convulsion, the face remaining distorted, the eyes projected and the mouth foamy.

On opening the body, forty-eight hours after death, congestion of the scalp, of the membrane of the brain and of the brain itself were observed; each incision caused an abundant flow of black blood; the lungs were engorged and the auricles of the heart filled.

Intestines.—On the exterior of a rosy tint, in the interior the mucous presented some reddish stains, more decided in the stomach, and which could be attributed only to the essential oil which always accompanies hydrocyanic acid, as the latter does not leave any trace of inflammation. Several lumbrics, from 5 to 8 centimetres long, existed in the small intestines; it is to this latter cause that the voracity of the patient is attributable. His allowance was insufficient for him, and it was to satisfy his appetite, as he would have said, that he ate the flowers which killed him so rapidly.

The toxical effect of peach flowers is explained by the action of the hydrocyanic acid, which, according to whether it is more or less concentrated, stupifies the nervous system more or less rapidly, and produces engorgement of the veins, the prolongation of which may be considered as the proximate cause of death. On the other hand, stupifying substances, when diluted, having a fugaceous action, when the effect is not sudden, the first step to be taken is to counteract by bleeding the phenomena of the consecutive stasis of which we have spoken. In a case of poisoning by the water of the cherry laurel, Dr. Renaudin obtained a complete restoration of the patient, by immediate bleeding, which had the effect of reanimating the circulation.*

* *Annales Medico-psychologiques.*

* M. Loret has communicated to the Society of Medicine of Nantes a case of poisoning by a decoction of peach leaves. See *Journal de Chimie Medicale*, 1837, p. 99.

FRAUDULENT LIQUOR SARZÆ COMP.

London, 16 January, 1851.

To the Editors of The Chemist.

Gentlemen—I am desirous of drawing your attention to a fraud (one of many

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with which I am acquainted), which appears to be in very active practice amongst our friends who deal in sophistications no less than in preparations of medicine.

I allude to that most harmless though valuable medicine, sarsaparilla, whose decoction and extract are adulterated in a barefaced and shameful manner; I believe a common practice is as follows:—

R Dec. Sarsæ C. verum, at 4s. 6d. per lb..... 14 lbs.
Mucilago acaciæ..... 14 lbs.
S. V. R..... q. s.
Mix, and sell as Liquor Sarsæ Co. at 1Gs. per lb.

If some of your readers would take the trouble to examine their purchases a little more closely, they would render a public benefit by exposing some of their criticisms, and would cease to patronise the scoundrel whose only aim is to "put money in his purse."

With your permission, I shall go a little further into this matter, when your space will permit.

I am, gentlemen, your faithful servant,
AN OVERSEER.

[We shall be most happy to hear further from our correspondent on this most important subject, and also relative to such other frauds as he is acquainted with. Exposure in these cases almost invariably does good, not only to the public, but to the honest manufacturer, both of whose interests it is our province to protect. The disgraceful fraud exposed by "An Overseer" will now meet with less success, owing to his exposure.

Our columns are ever open to such communications, and would contain more of them, but that chemists buy too frequently on the faith of the respectability of those with whom they deal; a respectability too frequently earned by wealth — the very result of such shameful frauds as this.]

ON A CEMENT FOR STOPPING THE CAVITIES OF TEETH.*

BY T. J. HERAPATH, F.C.S.

A GOOD cement for stopping the cavities of carious teeth has long been a great desideratum to dentists, because, unfortunately, almost all those now known possess some disadvantage or other. Even the copper-amalgam, hitherto the one most preferred by the members of this profession, and of which the analysis and mode of preparation have been recently described by M. Pettenkofer,* is apt to communicate a very unpleasant metallic taste to the food, and soon becomes discolored, in consequence of the formation of a thin film of black sulphuret of copper. But in the course of the last few months another succedaneum, the invention of an American gentleman, has been brought into notice; and this would appear to possess every requisite that could be desired. The substance referred to is an alloy of tin and cadmium. When combined with a small quantity of mercury, it becomes soft and semifluid, and may then be easily pressed into the cavity of the decayed tooth, where it soon solidifies into a hard, tenacious, crystalline amalgam, thus preventing the access of air to the interior of the tooth and rendering the organ fit for the purposes of mastication. Being at the same time of a dull white color, similar in appearance to frosted silver, and not liable to become tarnished, close scrutiny is required in order to detect its presence. The great advantage of this latter property need not be pointed out.

When about to be employed, the alloy in fine powder is mixed up by the operator in the palm of his hand, with from two and a half to three times its weight of mercury, or such a quantity as will suffice to render it perfectly soft, when it is immediately pressed into the cavity in the enamel, the latter having been previously cleansed and dried by the ordinary method.

The alloy above described, as may be naturally supposed, is readily acted upon by acids, even by the diluted vegetable acids, which gradually dissolve out the cadmium. But as the salts of cadmium do not appear to produce any injurious action upon the system, unless taken in large quantity, of course no ill effects need be expected to result from this circumstance.

This metallic combination of tin and cadmium presents us with another interesting example of the effects of crystallisation and amorphism on the physical properties of bodies. As in the case of the copper-amalgam before adverted to, the specific gravity does not appear to vary in the transition from the amorphous to the crystallised condition, as the amalgam, when hard, occupies very nearly, if not exactly, the same space that it does when soft and fluid.

* *Quarterly Journal of the Chemical Society*, January 1, 1851.

* *Ann. Ch. Pharm.* June, 1849.

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In conclusion, I may observe, it has been found that, the proportion of the cadmium may be considerably reduced without altering the physical properties of the compound. A mixture of 5 parts of cadmium and 7 to 8 of tin is the best, and has been found to answer remarkably well.

A quantity of the cement in question was placed in my hands some time since by a friend who wished to learn the nature of its components. Upon subjecting it to analysis, it was found to consist of tin and cadmium in the following proportions :

grs.	grs.	grs.
8·90 gave	3·962 of SnO^2 and	6·629 of CdO
10·00 ,,	4·460 of SnO^2 ,,	7·429 of CdO
10·00 ,,	4·630 of SnO^2 ,,	7·422 of CdO

It would therefore appear to be composed of:—

	I.	II.	III.	Mean
Tin	34·899	34·960	34·980	34·946
Cadmium	65·061	65·010	64·950	65·007

and must therefore be considered as an alloy of these two metals in the proportion of one atom of the former to two of the latter.

The best mode of preparing it I find to be as follows:—Melt a quantity of bees'-wax in a pipkin over the fire, and then throw in the cadmium; by these means, the loss of cadmium which would otherwise result from oxidation is avoided. So soon as the metal is completely fused, add the tin in small pieces till a perfectly homogeneous alloy is formed. This can be afterwards granulated in the usual manner, or by introducing it into a wooden or iron box, and shaking it up rapidly while it still remains in the fluid state.

Since the above was written, I have analysed another and somewhat similar cement, which was stated by the inventor to be composed of platinum and tin. A quantitative examination, however, proved it to possess the following composition in 100 parts :—

Silver	73·188
Tin	21·127
Zinc	slight traces
Platinum with very slight traces of gold	5·685
	100·000

ON CHLORATED HYDROCHLORIC ETHER.*

BY M. MIALHE.

Dr. Aran having requested me to place at his disposal the various volatile agents in which he has recognised anæsthetic properties, for the purpose of studying, with more care than he had hitherto done, their local sedative action, we sent to him at two different times, liquids obtained by the reaction of chlorine on bicarburetted hydrogen, which had been supplied by two of the principal manufacturers of Paris, under the name of Dutch liquor. The first of these liquids furnished M. Aran with very satisfactory chemical results, which he hastened to make known. It was not the same with the second. We have considered it necessary to investigate the causes of this difference of results, and have ascertained that the last of these liquids alone possessed the characters of Dutch liquor, whilst the first rather resembled liquid chloride of carbon than Dutch liquor properly so called, being of a higher density and boiling-point than that liquor, and, moreover, it was not inflammable. In pursuing our comparative researches, we ascertained that this liquid was not chloride of carbon, but Dutch liquor which had lost a certain quantity of hydrogen and which had acquired an equivalent proportion of chlorine, that is to say, chlorated Dutch liquor.

It is therefore certain that the beneficial therapeutical results recently published by M. Aran relate to chlorated Dutch liquor, and not to Dutch liquor properly so called. But the price of chlorated Dutch liquor being too high for this substance to be advantageously introduced into therapeutics, we have thought that an analogous etherial compound, arising from the action of chlorine on hydrochloric ether, might be substituted for it.

It results, indeed, from the beautiful researches of M. V. Regnault, that chlorine, in acting on hydrochloric ether, is substituted for the hydrogen removed, giving rise to a series of compounds more and more rich in chlorine, which are all isomers of the corresponding terms of the series of bicarburetted hydrogen. The isomerism is complete, for not only is the elementary composition the same, but the vapor densities are also identical. The order of molecular arrangement alone is different, as the chemical reactions clearly establish.

We were therefore of opinion that these two etheriform series would be endowed with the same therapeutical properties, and, consequently, that chlorated Dutch liquor, just mentioned, might be substituted in medical practice by the corresponding chlorated hydrochloric ether. This new compound, tried on patients by M. Aran, completely confirmed our supposition, and is therefore possessed of the same therapeutical virtues as chlorated Dutch liquor.

* *Comptes Rendus*, No. 26, 23 Dec., 1850.

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This compound is colorless, very fluid, having an aromatic odor analogous to that of chloroform, or, rather, to that of Dutch liquor: it has a sweet and, at the same time, a pungent taste; it has no action on litmus paper; it is sparingly soluble in water, but dissolves perfectly in alcohol, sulphuric ether and most of the fixed and volatile oils; it is not inflammable, which distinguishes it from Dutch liquor and officinal ethers, and is a point of resemblance to chloroform; it has a variable density and boiling point, the latter being between 230 and 266° F.: which evidently indicates that this body does not consist of one substance alone, but in the union of several ethers, of different density and elastic tension.* As these various chlorated hydrochloric ethers all possess the same anæsthetic properties, and as, besides, it would be impossible to separate them accurately from each other, we propose to designate the liquid which they constitute by the generic name of chlorated hydrochloric ether.

Such are the principal properties of this new anæsthetic agent, which we regard, with M. Aran, as likely to play an important part among local sedatives.

ON THE ASSAYING OF CINCHONAS WITH CHLOROFORM.†

BY M. RABOURDIN.

I SHALL endeavor in this paper to establish a means of estimating the alkaloïds of the cinchonas, by availing myself of the property possessed by chloroform of dissolving these bodies in an aqueous liquid.

TO TEST GREY CINCHONA.

Forty grammes of the bark of the grey cinchona of commerce, pulverised and passed through a fine hair sieve, are moistened with a sufficient quantity of water acidulated with hydrochloric acid (20 grammes of acid to 1 kilogramme of water), and put into a small funnel. A sheet of filtering paper is placed above, and acidulated water is poured on to lixiviate the powder, until the liquor passes through colorless and free from bitterness (when the powder is uniformly and properly heaped up it is exhausted when from 200 to 250 grammes of liquid have been collected); 5 or 6 grammes of caustic potassa and 15 grammes of chloroform are then added to the liquid; it is well shaken for a few minutes, and then left to repose. After some time, but not exceeding half an hour, the chloroform is deposited, and with it all the cinchonine. The transparent red liquor above the precipitate is then carefully decanted; water is added several times, decanting it each time, until the precipitate is well washed; it is then put into a porcelain capsule. This substance is composed of one part of liquid, which is a chloroformic solution of cinchonine, one part rather solid reddish matter, formed of cinchonine, of chloroform in a divided state and as if in emulsion, and of cinchonic red. The capsule is placed on a bath of boiling water to drive off the chloroform, and the residue is treated with water acidulated with hydrochloric acid, which dissolves all the cinchonine and a portion of the cinchonic red. It is filtered, and liquid ammonia diluted with fifteen or twenty times its volume of water is added: this is added by degrees, stirring all the time, and is stopped as soon as a white cloudiness appears, which does not dissolve by agitation. This manipulation is to precipitate the cinchonic red without touching the cinchonine. It is necessary to seize the exact moment, which is however easily understood, the cinchonic red being precipitated in reddish brown flocks, the cinchonine, on the contrary, in white curdled flocks. When a sufficient quantity of weak ammonia has been added, the liquor, which should be colorless, is filtered, the filter is washed with a little distilled water, and the mixed liquors precipitated by an excess of ammonia; the precipitate, which is pure cinchonine, and of which it is easy to ascertain the chemical constituents, is collected, dried and weighed.

One experiment gave me 0·19 gr.; and a second, 0·195 gr. of cinchonine. Taking the highest number, we have 4·87 gr. of alkaloïd to 1 kilogramme of grey cinchona.

TO TEST YELLOW CINCHONA.

It is unnecessary to operate on more than twenty grammes of the bark of the yellow cinchona, the proportion of organic alkali being much greater in this species of cinchona than it is in the grey cinchona.

* The reaction of chlorine on hydrochloric ether gives rise to four ethers, which are the mono-, bi-, tri- and quadrichlorated: the mono- and bichlorated are the first obtained and most easily prepared, but they are too volatile to be advantageously employed as local anæsthetics; treated by an excess of chlorine, they are converted into tri- and quadrichlorated ethers, which are much more dense and less volatile. It is these last two liquors which constitute almost specially chlorated hydrochloric ether. Consult the memoir of M. V. Regnault, in *Annales de Chimie et de Physique*, 2nd series, vol. lxxi. page 353.

† *Comptes Rendus*, 2nd Dec., 1850.

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Twenty grammes of yellow cinchona, pulverised and passed through a fine hair sieve, are exhausted by acidulated water, as mentioned above in speaking of the grey cinchona. The flow of the liquor is stopped when colorless and insipid: from 150 to 200 grammes of liquid are obtained, to which are added from 5 to 6 grammes of caustic potassa and 10 grammes of chloroform. It is shaken, and left to repose; it deposits a very dense whitish precipitate, composed of quinine, cinchonine and chloroform; sometimes the separation is complete and instantaneous, leaving above a clear red liquor which may be immediately decanted; the chloroformic solution is washed; it is collected in a small capsule, and the spontaneous evaporation of the chloroform leaves the alkaloids in a state of purity.

I think it is unnecessary to speak of testing the red cinchonas; they behave like the yellow cinchonas, and all I have said of these last applies equally to them.

I regret that I have not had at my disposal all the varieties of cinchona found in commerce, I should then have tested the different varieties, and have offered a more extended work to the Academy; but as it would have taken a long time to procure the materials for a complete work on this subject, I have thought it best to confine myself to giving my method of analysis, which I trust may be found useful.

SYRUP OF BALSAM OF TOLU.*

BY M. BONNEWYN.

℞ Balsam of Tolu ..... 40 gram.
Alcohol at 35 degrees (Cart). 120 —
Dissolve by maceration and filter.
Then take
Of the above tincture of balsam of Tolu..... 15 gram.
Well clarified simple syrup .... 500 — †

To prepare this syrup properly the tincture is poured into a bottle containing 125 grammes of simple syrup, and shaken for five minutes; 125 grammes more syrup are added, and the agitation is repeated; finally, the remaining 250 grammes of syrup are poured in, and the whole is once more agitated; it is then preserved in the same bottles, well stoppered.

Sufficient empty space should be left in the bottle for the agitation to be easily performed.

The syrup prepared by the above process has the advantage of being clear, containing no lumps, and never becoming covered by a pellicle; it has besides the property of being odorous, and of retaining a softer odor and flavor than the syrup prepared by any other method.

I attribute these advantages to the fact that, in my process, the syrup is made cold, and to the quantity of balsam of Tolu contained in it.

* *Journal de Pharmacie d'Anvers.*

† I do not advise the preparation of more than 16 ounces of syrup at a time, as this syrup is easily prepared.

CONCENTRATED SOLUTION OF TANNIN IN AFFECTIONS OF THE EYE.*

BY M. HAIRION.

In all formularies we find ordered collyria of tannin, injections of tannin, &c., but in all these prescriptions the solution is very weak (1 to 2 grammes of tannin in 120 grammes of distilled water). Tannin, in collyrium, is by no means new; but M. Hairion's improvement consists in the high dose in which he employs this astringent; thus the solution which he prescribes is ordinarily 1 gramme of tannin to 3 grammes of distilled water; sometimes he employs it in fine powder, in ointment, or else he makes a thick mixture of it, but in all cases the proportion of tannin is proportionately high. He has experimented on acute and chronic blennorhœa, vegetating granulations, vascular and ulcerous keratitis, swelling of the conjunction, and pannus, and it is in this affection that he most extols it. In some cases complete cure was very rapidly effected. In vesiculous granulations he was less successful, especially when they were closed. M. Hairion expresses himself as follows:—

Tannin is of great utility, either for drying the mucoso-purulent discharges from the conjunctiva, relieving relaxation of that membrane, causing the subsiding of cellulo-vascular productions, the retreat of dilated or newly formed vessels, or, indeed, in producing coagulation of the plastic liquids, for accelerating cicatrization of ulcers of the cornea, strengthening its softened tissue, and preventing its propulsion or tearing. Besides, M. Hairion affirms that he has never found any inconveniences which could cause regret that he had employed the high dose which he used; it never gave rise to the least reaction, never caused any caustic effect or indelible incrustations, and, finally, its application is not painful to the patient.

* *Archives de Medecine Belges*, 1850.

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ON THE PREPARATION OF ARTIFICIAL OILY EMULSIONS.*

BY M. THORÉL.

A GREAT number of formulæ have been published, for the purpose of arriving at a prompt and easy emulsion of oils. I have tried all these, and it is because I have never succeeded well with any of them that I present, with the formula which I have always used, the manner of making it, without which it is impossible to succeed promptly. I also considerably reduce the quantity of water, a reduction that is not unimportant for purgative emulsions intended for infants.

PURGATIVE EMULSION OF CASTOR OIL.

Formula No. 1.

Castor oil	30	gram.
Lemon or other syrup	15	,,
Water	30	,,
Powdered gum arabic	4	,,

Formula No. 2.

Castor oil	45	gram.
Lemon syrup	25	,,
Water	45	,,
Powdered gum	6	,,

Formula No. 3.

Castor oil	60	gram.
Lemon syrup	30	,,
Water	60	,,
Powdered gum	8	,,

OILY LOOCH.

Oil of sweet almonds (fresh)	30	gram.
Powdered gum	30	,,
Simple syrup	50	,,
Water	60	,,
Laurel water	5	,,

To make these emulsions well and quickly, weigh the oil with the syrup, and pour them upon the gum; stir it quickly during one or two minutes, then add the water by small quantities at first, so as to prevent the separating of the oil.

For the looch, by the advice of several doctors, who asked whether it would not be possible to augment the proportion of oil, I put 30 grammes instead of 15; the preparation takes a little longer, but it is equally good.

I have remarked that the older the oil is, the more difficult it is to form the emulsion.

* *Répertoire de Pharmacie*, Dec., 1850.

COLLODION APPLIED TO BURNS.*

DR. LIMAN, of Berlin, states that he has found collodion a most excellent application to burns. He has applied it in many cases with the best results. He states that it allays the smarting, forms a protective covering, which excludes the action of the air, and is so exactly adapted to all parts that no other dressing is required. The first application is attended with some pain, but is soon followed by alleviation of the suffering, and the cure proceeds steadily without pain. Dr. Liman applied the collodion with a hair-pencil, covering the entire surface, and daily reapplying it to the fissures and uncovered parts. Dr. Liman relates one case in which it was applied in an extensive burn with immediate advantage, and ultimately a speedy cure, without remaining contractions of the integuments.

ON CASSIA LIGNEA (CINNAMOMUM AROMATICUM, *Nees.*)†

BY DU MENIL.

IF the decoction of cassia lignea which remains in the still after the preparation of aqua cinnamomi be evaporated to dryness, powdered, and treated with alcohol, a dark tincture, of an agreeably bitter aromatic taste, is obtained, which is well adapted for yielding an excellent liqueur. The author tested cassia lignea for alkaloïds, but obtained negative results. From his experiments he concludes that this bark contains a trace of *resin*, fifty-two per cent. of *vegetable fibre*, fourteen per cent. of *gum*, and eighteen per cent of tannin.

* Casper's *Wochenschrift*, 1850.

† *Central Blatt*, No. xxxvii., 1850.

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IV. REVIEWS, NOTICES OF BOOKS, &c.

THE LONDON AND PROVINCIAL MEDICAL DIRECTORY. 1851. London: John Churchill.

The profession is greatly indebted to the proprietor of this most useful work, which contains a street list in which the names of medical men residing in each street is given; lists setting forth the name, address, qualification and published works of every known qualified Physician, Surgeon and General Practitioner in London and its vicinity, another of those practising in the Provinces —Homœopathic and Hydropathic practitioners—Public and Private Lunatic Asylums, Universities, Colleges, &c., of England, Scotland and Ireland, Hospitals, Schools of Medicine, Scientific Corporations and Institutions, with much other matter of interest and utility to the Medical Profession, including the ordinary matter of an almanack.

We recommend this work to the support and encouragement of our medical readers. It is one which must require an extensive sale to reimburse its proprietor the immense outlay in getting it up. No member of the profession should be without it, as he is by it enabled to ascertain the qualification, or the absence of it, possessed by others, and this is frequently of use for stopping unqualified persons.

BOOKS RECEIVED.

The Journal of the Royal Agricultural Society of England. Vol. XI. Part II. No. xxvi. 1850. London: John Murray.

The Dublin Quarterly Journal of Medical Science. Dublin: Hodges and Smith. London: Longman and Co.

TO CORRESPONDENTS.

NOTICE.—We are about to prepare some elementary articles, which will give to beginners an insight into the Science of Chemistry, and hope to have the first ready for our March number.

"CHEMICUS."—We recommend a careful re-perusal of the article referred to.

"A NOVICE" has performed his experiments correctly, and is quite right in his conclusions.

"A. B." (Liverpool) should study under some respectable teacher, who will be able to afford him the advantage of a good laboratory and the requisite apparatus. He will thus save much time, and arrive at a more accurate knowledge of chemistry.

"AN AMATEUR" will receive the foregoing as his answer.

"M.P.S.,"—The remedy lies with yourself.

"MALCONTENT" should act up to his feelings.

Answered by post. "A Professor;" "Omega;" "A Student;" "A Member of the Pharmaceutical Society," London; "A.P.S.;" "Delta;" "M.D.;" "Chirurgus;" "T. H. H.;" "I. D.;" "Q;" "W. M. S.;" "N. S. L."

NOTICE.—*All Communications, Books for Review and Substance for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

RESEARCHES ON THE CAUSES WHICH DISENGAGE ELECTRICITY IN VEGETABLES, AND ON VEGETO-TERRESTRIAL CURRENTS.*

BY M. BECQUEREL.

Since the immortal discoveries of Galvani and Volta, researches on the disengagement of electricity have taken a more philosophical direction. Endeavors have been made to discover not only the causes which operate this disengagement, but likewise the relations existing between electricity, molecular attraction and affinities. These researches have likewise had for their object the study of electro-physiological phenomena; although this part of electricity is less advanced than the other, still the remarkable works of Nobili, Marianini, Matteucci, Bois-Reymond and several other philosophers, prove that, as regards general physics and physiology, it is not in vain that we seek to discover the presence of electricity in some of the principal acts of life, as well as in the constitution of organised bodies.

The causes which disengage electricity in organic bodies, during life, or when it has ceased only a short time, are physical, chemical, and perhaps organic; in the latter case, they are connected with certain vital functions which have not yet been clearly defined.

The object which I propose to myself in this memoir is, to explain the process to be followed for arriving at the discovery of the physical and chemical causes which operate in the production of electro-physiological phenomena, as well as the results which I have obtained in operating on vegetables, whose constitution, being more simple than that of animals, is more easily adapted for experiment than the latter.

Some preliminary details are indispensable for the proper understanding of the subject.

Organised bodies, when they belong to the animal or to the vegetable kingdom, are composed, the former of osseous, tendonous, membraneous and fleshy parts, &c., moistened or filled with liquids which render them more or less conductors of electricity; the second, of fibres, vessels and stems, likewise containing liquids by means of which they are conductors. These liquids, by reason of their exclusive conducting faculty (the solid parts not possessing it), play, therefore, the principal part in the production of the electrical effects observed in organised bodies, even when the vital action intervenes in some cases. These liquids, considered two by two, necessarily give rise, in their mutual contact, in consequence of the reactions which result from them, to electrical effects rendered sensible not only with the condenser, by putting one of the liquids in contact with glass, and the other with one of the plates, but also with the multiplier, by forming the circuit with two plates of platinum immersed in these liquids.

The chemical reactions may also give rise to electric currents without the intermedium of platinum plates, when the solids and liquids are arranged as will be described further on.

Having regard only to the chemical origin of the currents produced in the interior

* *Annales de Chimie et de Physique*, January, 1851.

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of organised bodies in order to interpret them, it must be borne in mind that, when two different liquids, separated by a permeable membrane, are put in communication by means of two platinum plates in connection with a multiplier, the magnetic needle is deviated in a direction which indicates that the liquid which acts as an acid liberates positive electricity, and that which acts as an alkali, negative electricity. The intervention of metallic plates is here indispensable for the production of electric currents, but it is useless when solid substances, non-conductors and permeable, are arranged as I have made known to the Academy (*Comptes Rendus*, t. xxiv., page 505). This arrangement consists as follows.

When we put in communication, by means of two platinum plates, a solution of potassa and nitric acid, separated by a thin layer of clay, the acid liberates positive electricity, as I have just stated. If we substitute for the plates an U tube, of 1 decimetre in length, filled with damp clay free from calcareous matters, and prepared in such a way that the part which is steeped in the acid may be less and less acid, and that the other may be less and less alkaline, in order that there may be only one chemical reaction, where the thin layer of clay is, we have an apparatus by aid of which, in breaking the tube in order to have two conductors or rheophori, decomposition may be effected.

Such arrangements present, without doubt, in the interior of organised bodies, composed of more or less permeable solid parts, and of liquids which mix only with difficulty, under the influence of life, the strength of the tissue presenting an obstacle to it.

Formerly, when public attention was called to the admirable discoveries of Volta, Dr. Baccomio, of Milan (*Annales de Chimie*, 2nd series, t. lxii., page 212), endeavored to construct batteries with organic matters of vegetable origin, as Matteucci did, some years ago, with portions of muscles of different animals; but nothing proves that the effects obtained by the former are due, like those of the philosopher of Pavia, to the action of a battery. How, indeed, did Dr. Baccomio experiment? He constructed a battery with discs of beet-root of 5 to 6 centimetres in length, and discs of walnut tree of the same dimensions, with which he made the frog contract, by taking as an excitant leaves of cochlearia; now, as nothing proves that such an effect would not have been produced by a single couple, it cannot therefore be concluded that the column formed of discs of beet-root and discs of walnut tree acted as a battery, especially in comparing the effect produced with the following facts.

M. Donné obtained derived currents in animals and vegetables, by putting in communication, by means of metallic plates or wires in connection with a multiplier, from liquids of different composition contained in the same body, and reacting chemically on the surrounding liquids. Having placed a sheet of platinum in the mouth, which is ordinarily alkaline, and the other on the skin, which secretes an acid, the magnetic needle was deviated from 15 to 20 and even 30 degrees; the mucous membrane of the mouth, by reason of its alkaline nature, furnished to the current negative electricity, and the skin positive electricity.

M. Donné obtained similar effects in experimenting on the stomach and liver, one of which secretes an acid and the other an alkali; the effects were consequently the same as if the acid liquid had acted directly on the alkaline liquid.

Analogous effects are produced in fruits. Having inserted two platinum needles, one at the side of the stalk and the other at the side of the bud, the magnetic needle was deviated from 15 to 20° according to the kind of fruit.

In apples and pears, the current went from the stalk to the eye; in the peach, apricot and prunes, these effects were inverted. Instead of plunging the needles parallel to the plane passing by the eye and the stalk, he inserted them in the two sides perpendicularly to this plane, and at equal distance: in this case, no current was produced.

The effects produced in these different cases were evidently due to a heterogeneousness in the composition of the liquids, reacting chemically on each other by the intermedium of the tissues which separate them. In cutting a prune into two pieces perpendicularly at the line joining the stalk and the eye, expressing the juice of each half into two separate vessels, then, closing the circuit, on one hand by means of two platinum plates and on the other with a strip of moistened paper, a current was obtained whose direction was the same as by operating directly on the fruit.

Instead of cutting the fruit in the direction indicated, it was divided into two parts following a plane passing from the eye to the stalk, and operating as above, no sign of electricity was obtained. These experiments evidently prove that the effects observed had a chemical origin.

This mode of experimenting is perfectly suitable for proving, at all times, in organ-

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ised bodies, by means of two metallic conductors, the production of electric currents resulting from the action on each other of two different liquids, separated by permeable tissues or membranes. Instead of metallic conductors, a frog may be used, prepared according to Galvani's method, which indicates, by contractions, the electrical effects produced as soon as the circuit is formed.

Do the effects which are manifested take place naturally without the intermedium of metallic conductors or the frog? This is a question to which I shall give the reply further on; for the present, I shall confine myself to recalling to mind that as often as two liquids react chemically on each other, if these liquids do not form part of a closed circuit, there is an immediate recomposition of the two electricities disengaged on contact; whilst if one of the two liquids is put in communication with the earth, we lose, by evaporation, the electricity which it possessed, the electricity of the other liquid may be collected with the conductor. Such are the data which will serve us in studying the questions which form the subject of this memoir.

I. ELECTRICAL EFFECTS PRODUCED IN THE CIRCULATION OF THE SAP.

There exists in vegetables an ascending sap, and a cortical sap which differs from it in composition, and to which physiologists attribute a descending motion; both are separated by tissues, and produce electrical effects analogous to those above mentioned. These effects are so much the more remarkable, as they have a relation to the constitution of the bark and that of the ligneous matter. To interpret them, it is necessary to recapitulate, in few words, what we know concerning the nature and distribution of each sap.

The stem of a dicotyledonous ligneous plant is formed of two distinct parts, separated by a demifluid substance which many physiologists regard as a demifluid tissue, called the cambium, which would be the principal element of vegetable organisation. The external part is the bark; the internal, the wood, properly so called. The bark is composed, independently of the parenchyma, of the epidermis, of the tuberous envelope, of the lactiferous vessels and of the cortical fibres.

The wood is formed of medullary radii, of ligneous bundles and of the pith. The bark, contains, then, like the ligneous system, a cellular and a fibrous portion; only these portions are placed inversely. The parenchyma, which is analogous to pith, occupies the circumference of the bark, whilst the pith is in the centre of the ligneous system. This inversion corresponds, as will be seen, to inverse electrical effects.

Each stem or branch being composed of uninterrupted series of heterogeneous concentrated layers, their successive contacts should give rise to electrical effects resulting from the homogeneousness of the liquids moistening. These effects are rendered sensible: 1. By means of platinum needles, introduced in two contiguous layers, or at a greater or less distance, reacting on the neighboring layers. 2. By collecting with a condenser the electricity removed from the vegetable by the aqueous vapor exhaled by the leaves and by the oxygen arising from the decomposition of the carbonic acid under the solar influence: 3. likewise by making use of platinum needles, to determine the simultaneous electrical states of the vegetable and the earth.

The liquid with which the earth is moistened penetrates into the roots at their extremities by means of endosmotic and capillary action, passes into the cellules situated above, and arrives at the stem, where the ascensional movement continues; it dissolves a portion of the substances which it finds in its way, gradually acquires greater density, and thus constitutes what is called the sap.

The ascension of the sap is due not only to endosmotic and capillary action, but also to the presence of the buds which remove from the stem and branches the substances necessary to their development. The buds speedily form leaves, which become the seat of a continual evaporation, which also contributes to the ascensional movement of the sap, and intervenes, consequently, in the manifestation of electrical effects.

We do not know exactly what vessels the sap passes through in its evolution. It is only known that in spring it fills the cellules, fibres, vessels, &c., &c., and passes almost entirely through the ligneous body.

As soon as the ascending sap is constituted, it arrives in the young branches, is conveyed to the surface of their bark, into the parenchyma as well as the leaves. When once diffused into the green parts, it is in direct connection with the atmospheric air, from which it is separated only by thin perforated membranes, through which are operated the phenomena of respiration. The sap, which is profoundly modified, becomes less aqueous, owing to the evaporation of a portion of the water which it contained. The carbonic acid gas is decomposed, the carbon assimilated and the oxygen exhaled; the color of the leaves and of the young bark indicates that considerable

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changes have taken place in the sap. Does this sap, newly elaborated, redescend through the bark, depositing in its passage the matters destined for the formation of the tissues? Some physiologists doubt this. M. Biot's experiments tend to demonstrate the circulatory movement of the sap: in examining the optical properties of the ascending sap and of the parenchymous sap of the maple, he recognised that the first turns the plane of polarisation to the right, the second to the left, whilst the two saps of the birch act inversely, These experiments, which establish, according to M. Biot, a mutual dependence between the two saps, demonstrate their circulatory movements. It is certain that the parenchymous sap differs from the ascending sap.

The anatomical and physiological details into which I have just entered were indispensable for the interpretation of the electrical effects produced in all the phases of the movement of the sap, which effects are of a nature to interest, not only the vegetable physiologist, but also the meteorologist.

I now come to experiments. Let a transverse section be made of the stem of a young poplar (when it is in sap), so as to show visibly all the concentric rings of which it is composed. If we introduce simultaneously the extremities of two platinum needles, not polarised, covered or not covered with a layer of distilled water, and in communication with a multiplier, one in the pith, and the other in one of the envelopes of the ligneous or of the cortical system, the magnetic needle is deviated 5, 10, 15 and even a greater number of degrees, according to the sensibility of the apparatus, the sevous nature of the vegetable, and the nature of the envelope in which the second needle has been placed. The direction of the deviation, which is invariable, indicates that the pith furnishes positive electricity to the needle in contact with it, and the external envelope negative electricity to the other needle; there is, therefore, a current from the exterior to the interior.

The magnetic needle, after having oscillated for a short time, takes up a position of equilibrium which is not fixed, the deviation diminishes gradually, but never reaches zero.

This diminution in the intensity of the current is due to the polarity acquired by the platinum needles, which produces a current directed in the inverse direction of the first, which destroys the action of the latter. The primitive current is so much the more intense, *ceteris paribus*, as the needle introduced into the bark is as near as possible to the epidermis, and consequently in the green part of the parenchyma.

In withdrawing the first needle from the pith and introducing it gradually into the part nearest the bark, we obtain currents which diminish in intensity, although always directed in the same direction: and that, until this same needle is placed between the ligneous matter and the bark, that is to say, in the part in progress of formation, to which the name of cambium has been given: the current then alters its direction, at the same time acquiring greater intensity.

If we remove a portion of bark, whose epidermis is easily removed, and apply a platinum plate to each surface, both plates being in connection with a multiplier, the effects acquire greater intensity; with the bark of a young branch of elder in full sap, we obtain deviations which sometimes amount to 90 degrees, and even make the needle spin round: it is thus ascertained that the *bark forms a voltaic couple*, whose external or parenchymous surface is the positive side, and the internal surface, still covered with parenchyma, the negative side. The action of this couple, when the bark is removed from the branch, soon ceases. To prove this, the epidermis was removed from a piece of the bark of a young branch of elder, and to each surface a platinum plate was applied: the whole was placed between two small pieces of wood, under a pressure of two kilogrammes. A current was immediately produced. By repeating the experiment at short intervals, taking the precaution of depolarising the platinum plates, it was remarked that the effects rapidly diminish, even when the surfaces are moistened with distilled water; sometimes they are not perceptible after half an hour. The electrical properties manifested by the bark, disappear, therefore, much more rapidly than those of the muscles of cold-blooded animals, which often subsist several hours after death.

When the bark is not detached from the branch, these properties are retained for several days, a proof that their disappearance is attributable to the chemical changes which take place rapidly in the sap in contact with the air. If, when the bark is in its place, the two needles be introduced, one under the epidermis, and the other between the bark and the ligneous matter, in the cambium, the electrical effects are manifested, not only as has already been described, but for several hours after, provided always that care be taken to leave the circuit open in order to destroy the effects resulting from the polarisation.

The bark constitutes, therefore, really a

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voltaic couple which rapidly loses the electrical faculty when, detached from the wood, it is left exposed to the air; whence it follows that in the reaction of the layer of air adhering to the surface of the platinum on the sap, effects must take place nearly analogous in intensity to those which occur on contact with the air. The layer of hygrometric water which adheres to the surface of the platinum appears to be without influence, since the effects are the same when the needles have been previously heated to redness.

To sum up, it is evident that from the pith to the cambium, the ligneous layers are less and less positive relatively to the pith, whilst from the cambium to the epidermis, the cortical and parenchymous layers are more and more positive, or at least act as such. In the production of derived currents, this inversion of the electrical effects accords with the position of the cellular tissue in the bark and in the wood: in the bark, it is to the exterior; in the wood, to the interior: in both cases it is positive.

Wherein, then, do the electrical properties of the bark reside? Is it in the various layers which compose the cortical system, or only in the epidermis and in the cambium? The following observations will serve, if not to reply categorically, to these two questions, at least to facilitate their solution.

A transversal section was made of a branch of elder in full sap; one of the needles was introduced between the bark and the ligneous matter, and the other was applied to the parenchyma, after having removed the epidermis: the magnetic needle was deviated a certain number of degrees, 20 degrees, for example. The second needle, which was applied to the periphery, was extracted, the green part was removed with an ivory knife, and the needle returned to its place; on the newly-denuded part, the magnetic needle experienced the same deviation. A second layer was removed with the ivory knife, and there was still a deviation in the same direction, but somewhat less powerful: it was about 15 degrees. By continuing successively to remove the parenchyma until arriving at the cambium, the electrical effects occurred in the same direction, and ceased only when nothing but the cambium remained. All the cortical parenchymous layers possess, therefore, the property of producing derived currents with the aid of two platinum plates or needles serving to close the circuit. Are we to conclude from this that all these united layers constitute a pile? Certainly not; the experiments hitherto made do not admit of such a conclusion.

Be it as it may, the cause which constitutes the bark a voltaïc couple and perhaps a pile, by the juxtaposition of the heterogeneous concentric layers of which it is composed, appears to be purely chemical. Indeed, the ligneous system is percolated by the ascending sap which is rich in oxygen, whilst the liquid contained in the cortical tissue, in traversing the green parts, continually loses a portion of this element in its contact with the air; these two saps, in reacting on each other, by the intermedium of the tissues which separate them, necessarily give rise to electrical effects: the ascending sap, which is the most oxygenous, must act as an acid with regard to the other sap, and liberate positive electricity, whilst the descending sap disengages negative electricity. As to the inversion of the electrical effects observed in the ligneous matter and the bark, which is in relation to the position of the cellular tissue; in each of these systems it can be attributed only to the nature of the liquids existing on the one hand in the pith and the adjacent parts, and on the other in the parenchyma and the cambium or the intermediate tissues.

The electricities disengaged, when one of the needles is introduced into the pith and the other into the parenchyma, have, I repeat, a chemical origin; for, if the two needles be withdrawn and steeped, while still covered with sap, in distilled water, the same effects are obtained with nearly the same intensity: which effects can be attributed only to the reaction on the water of the sap adhering to the surface of the needles.

In order to facilitate the introduction of the needles into the different parts of the stem, especially in the ligneous matter, which presents the most resistance, small openings are made with a steel bodkin, covered with a thick layer of gold, in order not to leave on the tissue perforated any trace of oxidisable metal capable of giving rise to secondary electrical effects.

In herbaceous and fatty plants, such as the cactus, euphorbia, &c., composed almost entirely of parenchyma, it becomes extremely difficult to observe the electrical effects already described, and which are so clear in stems provided with a cortical system.

In support of the foregoing, I will detail the following experiments, which will show at the same time the advantage which may be derived from this mode of experimenting, in order to form an idea of the promptitude with which the air reacts on the sap which is found in the green parts, modifying its composition.

The ascending sap, which is more oxy-

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genous than the parenchymous, or descending, sap, must disengage positive electricity in its reaction on this latter, as, indeed, has been observed. If we introduce the two platinum needles transversely under the epidermis, in the middle of the parenchyma, at the distance of 1 centimetre from each other, no electrical effect will be produced when the introduction is simultaneous, and when the needles are not polarised. When thus placed, if we remove one of the two needles and introduce it again into or near the place it had already occupied, a current is immediately produced which deviates the magnetic needle 40 degrees and even more, and whose direction indicates that the newly-replaced needle has acquired negative electricity. In operating in the same manner with the other needle, an invere effect is obtained, that is to say, the needle withdrawn and replaced in the parenchyma constantly takes negative electricity. This experiment succeeds well only when the wood is in sap and has been only a short time detached from the tree.

(To be concluded in our next.)

DESCRIPTION OF A NEW METHOD OF DETERMINING THE AMOUNT OF OXYGEN IN THE ATMOSPHERE.

BY PROFESSOR J. LIEBIG.*

THE admirable processes published by MM. Regnault and Bunsen are adapted for persons accustomed to manipulate with complicated physical apparatus. They require a certain dexterity and skill, and an expenditure of time, which render their employment exceedingly difficult or nearly impossible in innumerable cases in which it would be useful to know the amount of oxygen and carbonic acid present in the atmosphere. I have more especially in view the physiologist desirous of ascertaining the amount of oxygen and carbonic acid of the expired air in a series of analyses to be made daily for a number of days, the technologist desirous of examining the air from a furnace, or the physician wishing to know the composition of the atmosphere in a sick-chamber or the effect of ventilation. A method applicable to these purposes must not require any very complicated apparatus or any remarkable dexterity; they must be quickly and easily performed, and possess a certain degree of accuracy.

Now an alkaline solution of pyrogallic acid, the remarkable absorbent capacity for oxygen of which has long been known, presents all these conditions. When some solution of caustic potassa, and then a solution of pyrogallic acid, is conveyed into a tube filled with mercury, the liquids mix without alteration; but when a bubble of oxygen or of air is passed into the tube, the liquid immediately acquires a blackish-red or nearly black color, and the oxygen is as rapidly absorbed as carbonic acid by caustic potassa.

The quantity of oxygen which is absorbed under these circumstances by 1 part by weight of pyrogallic acid is enormous. According to the experiments of Döbereiner, 1 grm. of pyrogallic acid in an ammoniacal solution absorbs 0·38 grm., or 260 cub. centim. of oxygen; this is more than the quantity absorbed by 1 part in weight of sodium on its conversion into oxide, which only amounts to 236 cub. centim. In one experiment, which was made with especial care, a solution of 1 grm. pyrogallic acid in caustic potassa absorbed 189·8 cub. centim. oxygen. Since 1 grm. hydrate of potassa (KO, Aq), in order to pass into neutral carbonate, absorbs at 32° F. 192 cub. centim. carbonic acid, the absorbent capacity of pyrogallic acid for oxygen, it will be seen, is not less than that of potassa for carbonic acid. The following results, which were obtained with atmospheric air, will give an idea of the accuracy which is obtained by means of this method:—

	Volume of air after introduction of the caustic potassa.	Decrease in volume after introduction of pyrogallic acid.	Per cent. in volume of oxygen.
1.	221·5	46·5	20·99
2.	201·0	42·0	20·89
3.	193·0	40·6	21·03
4.	210·0	44·0	20·95
5.	204·5	42·5	20·77
6.	195·0	40·8	20·92
7.	200·0	41·8	20·90
8.	200·0	41·6	20·80
9.	200·0	41·5	20·75
10.	236·0	49·0	20·76
11.	258·0	54·0	20·93*

It will be seen that these determinations come very near to the best air analyses, and I have not the least doubt that they might be obtained quite as accurate if a cathetometer were used to read off the volumes, as

* Liebig's *Annalen*, Jan., 1851, p. 107.

* With the expired air of different persons I obtained the following results, some with gallic, others with pyrogallic acid:—

Air.	Decrease in volume by solution of potassa.	Decrease in volume by gallic or pyrogallic acid.	Volume of nitrogen.
1. 220·0	9·0	36·0	175·0
2. 221·5	9·0	36·0	175·5
3. 200·0	11·0	30·0	158·2
4. 194·0	10·0	29·0	155·0

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is necessary in accurate measurements. We then, it is true, lose one of the chief advantages of this method, which consists in the circumstance, that it is possible to make in the course of an hour half a dozen analyses of sufficient accuracy for most cases. The reason of this extraordinary accuracy, notwithstanding all the errors attached to the method, is evidently owing to its great simplicity and the quickness with which the operation is completed; it is owing to this that the errors caused by a change of temperature and of atmospheric pressure vanish; and the influence of the errors peculiar to this method is apparently not greater than the influence of the sources of error in the most perfect which we possess. The following was the mode of proceeding in the above-mentioned analyses:—

The air in which the amount of oxygen and carbonic acid was to be determined was measured in graduated tubes over mercury. The tubes would contain about 30 cub. centim., each cub. centim. divided into 5 parts; they were filled two-thirds with the air, the quantity read off, and now one-fortieth to one-thirtieth of its volume of solution of potassa of 1·4 spec. grav. (1 part dry hydrate of potassa to 2 parts water), introduced by means of the common pipette with a curved point: by quickly moving up and down the tubes in the mercury, the solution of potassa is spread over the whole inner surface of the tubes; and when no further decrease of space is perceptible, the decrease of volume is read off.

When the air has been previously dried by means of chloride of calcium, the decrease in volume furnishes with accuracy the amount of carbonic acid in the air; but when it is humid, the determination has an error attached to it, which is due to the absorption of the aqueous vapor by the strong solution of potassa.

After the carbonic acid has been determined, a solution of pyrogallic acid, containing 1 grm. of acid in 5–6 cub. centim. water, is introduced by means of a second pipette into the same tube, and amounting to about half the volume of the solution of potassa. The same plan is adopted as in the determination of the carbonic acid, that is to say, the mixed liquids are well shaken over the inner surface of the tube, and when no further absorption is perceptible, the amount of nitrogen remaining is measured off.

By mixing the solution of pyrogallic acid with the potassa, the latter is diluted, and an error arises from the diminution of its tension; but this appears to be so exceedingly small, that it is not determinable; at the same time, it may easily be avoided, if, after the absorption of the oxygen, a piece of solid hydrate of potassa corresponding to the amount of water in the solution of pyrogallic acid is introduced and allowed to dissolve.

Gallic acid may be employed instead of the pyrogallic acid, and with the same result; but its employment has the inconvenience, that the absorption of the oxygen requires at least one and a half to two hours, instead of as many minutes. Owing to the sparing solubility of gallic acid in water, it must be previously converted into gallate of potassa, a cold saturated solution of which is employed. When this liquid is neutral, or contains a very slight excess of acid, it does not experience any alteration in the air. Its property of absorbing oxygen only becomes active in the presence of an excess of alkali.

When the gallic acid has been mixed with the caustic potassa in the tube, the liquid, on coming into contact with air containing oxygen, assumes a dark red color; thin layers acquire almost a blood-red color, which after a time passes into brown. By the production of this blood-red color in the liquid, which moistens the sides of the tube on agitation, the progress of the absorption can be very distinctly traced; when this coloring is no longer developed, the operation is complete. With respect to the absorbent capacity of gallic acid for oxygen, it is known from Chevreul's experiments, that 1 grm. of gallic acid dissolved in strong potassa absorbs 290 cub. centim., or nearly 0·417 grm. oxygen. In this respect it is in nowise inferior to pyrogallic acid.

The following experiments were made with gallic acid:—

	Volume of air after introduction of the potassa.	Decrease of volume after introduction of the gallic acid.	Per cent. in volume of oxygen.
1.	269·5	55·5	20·59
2.	232·0	48·0	20·69
3.	217·0	45·5	20·97
4.	229·0	47·0	20·52
5.	191·0	40·8	21·35
6.	194·2	40·4	20·80
7.	192·5	40·0	20·78
8.	244·0	51·7	21·19

Consequently the corresponding air in the experiments contains—

	I.	II.	III.	IV.
Carbonic acid..	4·09	4·06	5·5	5·41
Oxygen.....	16·36	16·34	15·0	14·95
Nitrogen.....	79·55	79·23	79·1	79·90

These analyses have only been made to test the method, and have no value in a physiological point of view.

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The differences in these determinations are far greater than with the employment of pyrogallic acid; but they are less attributable to the process than to the errors which are caused by the change of temperature and atmospheric pressure. In the 1st, 2nd, 4th and 8th analyses, the decrease in volume was measured off the following day; the numbers expressed the result, without any correction for the state of the barometer and of temperature.

Under certain circumstances tannic acid may be employed instead of gallic acid; but the mixture of tannic acid and potassa absorbs oxygen still more slowly than the gallic acid. Pyrogallic acid, which is easily obtained, is certainly the best absorbent. 150 analyses may be made with 1 oz. of pyrogallic acid, and its price certainly presents no impediment to its use.

Dr. Stenhouse has described a most excellent method of preparing pyrogallic acid. He obtained, by sublimation from the dry aqueous extract of the gall-nuts, precisely in the same manner as benzoïc acid is prepared from benzoïn resin, above 10 per cent. in sublimed acid of the weight of the extract. When those who are engaged in photography have become convinced that in many cases pyrogallic acid is preferable to gallic acid, the increased demand for this acid will render its preparation still more productive.*

The principal error in the above eudiometrical process, which is scarcely to be got rid of, is occasioned by the difficulty of accurately reading off and determining the volume of the air, and its decrease from the absorption of the carbonic acid and of the oxygen, owing to the adhesion of the liquids to the sides of the tubes. This error becomes smaller when the precaution of using nearly the same volume of air for each analysis is adopted; but, although this method admits of perfectly trustworthy determinations in comparative analyses, it will not supersede the processes of MM. Dumas and Boussingault, or that of MM. Regnault and Reiset, or that of M. Bunsen for absolutely accurate determinations.

It is scarcely necessary to mention, that the process I have described is merely an application of the beautiful observations made by Chevreul and Döbereiner on gallic and pyrogallic acids, and that the merit of the discovery belongs to those illustrious chemists.

* By the dry distillation of Chinese galls in small retorts capable of holding from 5 to 6 oz. in coarse fragments, a very concentrated solution of pyrogallic acid is obtained, which, evaporated on the water-bath, yields of brown crystalline pyrogallic acid nearly 15 per cent. of the weight of the galls.

ON THE ELECTRO-CHEMICAL EFFECTS PRODUCED UNDER THE INFLUENCE OF LIGHT.*

BY M. EDMOND BECQUEREL.

I HAVE already had occasion to present to the Academy several memoirs containing observations relative to the electrical effects due to the chemical reactions which are operated under the influence of light. To observe these effects it is necessary to place the impressionable substances on the surface of metallic plates suitably arranged and connected with a sufficiently sensitive multiplier.

Moreover, having been led to the preparation of a chemically impressionable layer possessing the remarkable property of receiving colored impressions of all the parts of luminous radiation, as results from a work which has received the approbation of the Academy, I availed myself of this compound for studying over again the electrical effects due to radiation, in the hope of being enabled to appreciate the intensity of the active rays. Such is the object of the work which I now submit to the judgment of the Academy.

The first paragraph contains the description of the apparatus which I used, and which I have called the *actinometer*. This apparatus, in its most simple form, is composed of two plates of perfectly pure silver, rendered impressionable, and placed vertically in a small trough filled with water acidulated with sulphuric acid.

The two impressionable plates are both arranged parallel to the anterior face of the water trough, so that if the other faces of this trough are blackened, and if the light arrives only by the anterior face, one plate only is exposed to the action of the radiation. Each plate communicates, besides, with one of the extremities of the conducting wire of a multiplier of at least three thousand turns of wire.

The uniform preparation of the plates is the essential point, and the greatest attention should be paid to it. To effect it, the method indicated in a former memoir, (*Annales de Chimie et de Physique*, 3 série, tome xxii, 451, and tome xxv, 447,) is followed, by means of which each plate is rendered capable of receiving, by means of light, a colored impression of the same tint as the rays which strike it. It must be re-

* *Comptes Rendus*, No. 3, Jan. 20, 1851.

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marked, however, that it is necessary to give greater thickness to the impressionable layer, than is directed in the above-quoted memoir, and that if the comparative thicknesses of this layer be estimated by the tints of the thin layers which are developed in this case, we must stop at the thickness corresponding to the green of the colored rings of the fifth order. If the plates be afterwards heated they may be used in experiments.

When once the plates are placed in the water trough, and in communication with the multiplier, we must wait until the electric current due to the primitive polarization has ceased, before commencing the experiment.

When these various conditions are fulfilled, the apparatus being placed in a camera obscura, if a bundle of solar rays be directed on the surface of the anterior plate, the needle of the multiplier is driven violently in such a direction that the plate exposed to the radiation takes negative electricity. On intercepting the light, the needle gradually returns to zero.

The light of a taper, placed at 1 decimetre from the water trough, is sufficient to make the magnetic needle of the multiplier deviate from 12 to 15 degrees.

When solar or artificial light acts on the plate, we have more or less deviation, which continues so long as the light retains the same intensity, and as the surface remains sufficiently impressionable. For this reason, it is necessary to give sufficient thickness to the sensible layer: in acting thus, by means of a lamp, we have been able to maintain the magnetic needle at nearly the same degree of deviation for several hours.

When the sensitive layer is thinner, it rapidly loses its sensibility, and the same luminous bundle gives weaker and weaker deviations.

If the light be made to act only long enough to observe the deviation of the needle of the galvanometer, and if the action of the radiation be then stopped, the same sensibility of the apparatus is retained for a whole day (between certain very extended limits of intensity). The results are, then, comparable during the whole of this time, but, by prolonging the action, the water ultimately loses its impressionability.

The second paragraph of this work relates to the action of the differently refrangible rays. It is necessary, in these experiments, to expose only a small portion of the plate to be acted on by rays of determined refrangibility, in order to effect it uniformly. I have found that when the plates are struck by the rays comprised in the red and violet, a disengagement of electricity is produced, whilst beyond these limits no effect takes place. Moreover, the maximum of action is situated in the most luminous part of the spectrum, between the black lines D. and E. According to these researches, the maximum occupies a rather different position, although very near that of the maximum of light indicated by Frauenhofer. It is possible that these two maxima will be found to coincide, when photometrical experiments are made by a process by means of which lights of different tints may be compared.

Thus, where there exist in the solar spectrum rays acting on the retina, an action is observed on the impressionable surface, and a deviation is produced in the galvanometer. The disengagement of electricity is so much the more energetic as the light is more intense; and in the parts of the spectrum where there exist no rays perceptible to the eye, no effect appreciable by the apparatus is manifested. The sensitive matter employed here is therefore acted on between the same limits of refrangibility as the retina and not at all beyond the violet, as occurs with other substances.

It likewise results from observations that if we place in the way of the solar rays, before their refraction in the prism, colored screens intercepting different luminous portions of the spectrum, we find, as I found some years ago with other compounds, that in the parts of the spectrum where the light is intercepted, there exists no action giving rise to a deviation of the needle of the galvanometer, and that in the lighted portions of the spectrum a development of electricity is observed, and, consequently, an action on the sensitive layer.

In the third paragraph, I examine the manner in which the electric current varies, when the bundle of rays incident on the sensitive matter changes in intensity.

I have been compelled to abandon the formation of tables of intensity as not appearing susceptible of sufficient accuracy. I then thought of deducing the intensity of the active rays from the greater or less extent to which a sensitive plate must be acted on in order to arrive at the same electrical intensity; but the results given in this memoir did not admit of this method being adopted. This comparison may, however, be arrived at by operating always on the same extent of impressionable surface, and varying, according to determined proportions, the intensity of the active rays until the needle of the galvanometer always

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indicates the same degree of deviation. The apparatus here described serves therefore for showing the moment at which each bundle has the same intensity of chemical action.

I regret that the season has not permitted me to complete the study of the phenomena detailed in this work; but it may be seen, from the foregoing results, that I have been enabled to construct an apparatus indicating the electrical power due to the chemical action produced by a bundle of luminous rays on the chromatically impressionable substance which I have described: moreover, this apparatus unites, to great sensibility, the property of being comparable to itself during a given time.

ON PHOLERITE.*

BY DR. J. LAWRENCE SMITH.

THIS mineral, which resembles pholerite in composition, has been found with the emery of Naxos associated with emerylite. It is white, lamellar, and somewhat crystalline, sometimes gray. It is soft to the touch like steatite, infusible before the blowpipe, and when heated with nitrate of cobalt becomes strongly colored blue. It is scratched with the nail, and has a specific gravity of 2·564 Its composition is identical with the pholerite of Guillemin, also with the mineral forming the gangue of the diaspore of Schemnitz. It was decomposed with carbonate of soda. It afforded—

		Pholerite of Guillemin.	Gangue of diaspore of Schemnitz, Smith
Silica...	44·41	42·93	42·45
Alumina	41·20	42·07	42·81
Lime....	1·21	,,	*trace* and mag. *trace*
Water..	13·14	15·00	12·92

This corresponds to the following formula, $Al^2O^3SiO^3 + 2HO$; but it is a question whether or not we should consider the water as existing in any definite proportion, and whether or not they did not all contain more water when taken from their localities. These hydrated silicates of alumina are numerous, and bear various names, but it is doubtful if many of them are entitled to much consideration as distinct species.

CHEMICAL RESEARCHES ON GOLD.†

BY M. E. PREMY.

GOLD is of all easily purified metals the one which chemists have least studied; the series of oxidation of this metal is evidently incomplete, and the compounds which the oxides of gold may form with the acids and alkalis are scarcely known.

The chemical study of gold is, however, highly interesting: it is known that this metal, like arsenic, boron and silicon, has an especial tendency to form acids in uniting with oxygen.

Before submitting to a new examination the principal compounds of gold, such as the chlorides, the purple of Cassius, fulminating gold, &c., I thought that it was important to study in the first instance the compounds of the oxides of gold with the alkalis, which are now employed in very great quantity in gilding by the humid way: it is the results of these first investigations that I have the honor of submitting to the Academy.

The protoxide of gold Au^2O, whose formula I have verified, is decomposed, as is known, when it is submitted to the action of alkalis, and is immediately converted into metallic gold and alkaline aurate; this oxide acts like protoxide of tin which is decomposed, under the influence of an excess of potassa, into tin and into stannic: it is, therefore, impossible to obtain compounds of alkalis and protoxide of gold.

The aurates are, on the contrary, easily produced; I have been able to determine their composition and to study them with care.

I prepare auric acid by boiling the perchloride of gold with an excess of potassa; when it is partially decolored, I precipitate the auric acid by sulphuric acid: to purify the auric acid, I dissolve it in concentrated nitric acid; I precipitate this solution by water, and I wash the auric acid until the liquor contains no more nitric acid.

Auric acid thus obtained is insoluble in the oxyacids and even in hydrofluoric; it dissolves, on the contrary, in hydrochloric and hydrobromic acid.

Auric acid combines immediately with potassa and soda: these solutions, evaporated *in vacuo*, allow the crystallised aurates of potassa and soda to deposit.

The aurate of potassa, which I have especially studied, crystallises in small silky *houppes*; it is very soluble in water: this solution is of a yellow color and presents an alkaline reaction. This salt decomposes below red heat, and gives metallic gold, peroxide of potassium and a disengagement of oxygen.

The analysis of the aurate of potassa enabled me to determine the equivalent of auric acid and the general composition of the aurates.

* Silliman's *American Journal*, Jan., 1851.
† *Comptes Rendus*, No. 27, Dec. 30, 1850.

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It results from my analyses that the formula of aurate of potassa is

$$PoO, Au^2O^3, 6HO.$$

In the neutral aurates, the proportion of oxygen of the acid is to that of the base as 3 to 1.

With the aurate of potassa may be prepared, by double decomposition, all the other metallic aurates which are insoluble; these aurates sometimes dissolve in an excess of precipitant; thus the aurate of lime is very soluble in chloride of calcium.

Aurate of potassa may be used as an electro-gilding bath, but not for gilding by dipping. In gilding by dipping, by Elkington and de Ruolz's process, it is therefore probable that the compound of gold which is formed by the reaction of the alkaline bicarbonate on gold is not aurate of potassa.

The reaction of aurate of potassa on sulphite of potassa is very interesting.

When sulphite of potassa is poured into aurate of potassa, a yellow salt is immediately precipitated, which crystallises in long satin-like needles. I have given to this salt the name of *auro-sulphite of potassa*; its composition may be represented by the following formula:—

$$Au^2O^3, (SO^2)^3+5(PoO, SO^2)+5HO.$$

In admitting this formula, this salt would be regarded as resulting from the combination of sulphite of potassa and neutral sulphite of peroxide of gold; but all the reactions of this singular compound tend to prove that the gold, oxygen and sulphur exist in it in a state of arrangement which is not consistent with the above formula.

It is difficult to admit, indeed, that auric acid, which does not combine with the oxyacids and which itself acts like a true acid, could unite with sulphurous acid, which reduces it with such facility.

It is better to represent the aurosulphite of potassa by the formula

$$PoO, Au^2O^3+4[PoO, (SO^2)^2], 5HO;$$

it is evident that this salt would be produced, according to this new formula, by the combination of 1 equivalent of aurate of potassa with 4 equivalents of bisulphite of potassa.

Having regard, moreover, to the mode of production, the properties and the composition of the aurosulphite of potassa, I am led to consider this salt as resulting from the combination of potassa with a ternary acid formed of gold, sulphur and oxygen, and resembling, consequently, the compounds which I obtained by putting in contact the sulphites and nitrites, and which I designated under the name of sulphonitrogenous salts, gold substituting the nitrogen in these salts.

Aurosulphite of potassa, like the sulphonitrogenous salts, can be preserved only in the dry state, or in alkaline liquors; when they are put into pure water, sulphurous acid is disengaged, and metallic gold is speedily deposited: the acids instantly decompose it.

Under the influence of heat, the solutions of aurosulphite of potassa give a very brilliant and adherent deposit of gold. The aurosulphite of potassa will acquire importance when I demonstrate that other metallic salts may, like aurate of potassa, combine with the sulphites to form compounds somewhat analogous to the sulphonitrogenous salts.

Such are the principal facts consigned in the memoir of which I have just read an abstract to the Academy; in my next communication, I shall determine whether gold can, in combining with oxygen, form, as has been stated, a salifiable base having the formula Au^2O^2, and an acid containing more oxygen than auric acid.

ON EPHESITE.*

BY DR. J. LAWRENCE SMITH.

This silicate is found with the emery of Gumuch-dagh, and occurs on specimens of magnetic oxide of iron. It is of a pearly-white color, and lamellar in structure; cleavage difficult. It scratches glass easily, and has a specific gravity of from 3·15 to 3·20. Heated before the blowpipe it becomes milk-white but does not fuse. At first sight it might be taken for white disthene. It is decomposed with great difficulty by carbonate of soda, even with the addition of a little caustic soda. The alkalis were separated by means of hydrofluoric acid.

Silica	31·54	30·04
Alumina	57·89	56·45
Lime	1·89	2·11
Protoxide of iron	1·34	1·00
Soda with a little potassa	,,	4·41
Water	3·12	3·06

This corresponds very nearly to the formula—

$$2RO, SiO^3+5(2Al^2O^3, 3SiO^3)+4HO.$$

Atoms.		Atomic weight.	Per cent.	Oxygen ratio.
Soda	2	781·6	7·08	1
Silica	6	3400·2	30·77	9
Alumina	10	6416·2	58·08	15
Water	4	450·0	4·07	2

This mineral has been designated *Ephesite* from its occurrence at the emery locality near the ancient city of Ephesus.

* Silliman's *American Journal*, Jan., 1851.

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NEW RESEARCHES ON THE COMPOSITION OF THE GASES OF BLAST FURNACES, AND ON THE THEORY OF BLAST FURNACES.*

BY M. EBELMEN.

SEVERAL works have of late years been published on the composition of the gases evolved from the blast furnaces employed in the smelting of iron-ore. M. Bunsen was the first to treat of this subject, in his examination of the gases from the blast furnace of Veckerhagen. Analogous researches, which I submitted to the Academy in 1842 and 1844, were derived from four different furnaces, viz., those of Clerval and Audincourt, in which wood was the fuel employed; and those of Vienne and Pont-l'Evéque, in which coke was used. The theoretical conclusions to which I was conducted from these four series of experiments, were in perfect accordance with each other, and of the greatest exactness. They, however, differed much from those which had been presented by M. Bunsen.

Since the publication of the communications referred to, Mr. Playfair analysed the gases from the blast furnaces of Alfreton, in England, in which coal is the fuel employed. On this occasion he compared my results with those obtained by him at Veckerhagen and at Alfreton. These last confirm several of the most important points in my former communication.

The analytical process which I followed in my first researches was based on the employment of oxide of copper, as the agent of combustion. The determination of the various elements of the mixed gases resulted from weights, and not from modifications of volumes, as in the eudiometric method. M. Bunsen attributes the essential differences which exist between his results and mine, to the method of analysis which I have pursued, and which, he regards as less correct than the eudiometric method.

In my memoir I discuss the objections of M. Bunsen, and, at the same time, I point out the causes of error which are presented by the eudiometric method, and which appear to me to have occasioned great errors in the determination of the combustible elements of his mixed gases. But the process used by M. Bunsen to obtain the gases in the blast furnaces, and which I consider very defective, appears to me to be the principal cause of the differences between his results and mine.

In order to confirm as far as possible the results of my first researches, I have undertaken two new series of experiments, one on the gases of the blast furnace of Clerval, in which wood is used; the other, on the gases of one of the blast furnaces of Seraing (Belgium), where coke is the fuel employed.

The gases were collected in glass vessels, sealed by the blow-pipe, and were this time analysed in the eudiometer, according to the process recommended by MM. Regnault and Reiset. The results I obtained are in most perfect accordance with those I had previously obtained by weight. The only difference observed, related to the presence of some thousandths of proto-carburetted hydrogen gas in the gases of the upper part of the blast furnace in which wood charcoal was employed as fuel.

At Clerval the gases were collected at five different heights of the furnace. I found, by analysis, that the ascending gaseous current, which is necessarily formed in the lower region of the furnace, by carbonic oxide and nitrogen, is successively charged with the volatile products from the fused mass, at the same time that the carbonic acid is partially changed into carbonic oxide by the reduction of the iron ore. The *zone of reduction* which, in 1841, was comprised between 2·67 and 5·67 of the depth below the furnace mouth, was, on this occasion, much nearer the upper part of the furnace. This circumstance accords well with the results obtained in the employment of hot air in blast furnaces. In 1841, the air was heated to 392° F. At the period of my last experiments cold air was used. The temperature of the lower part of the furnace was much higher in the last than in the former case.

With this sole difference, which has reference to the circumstances of the action of the furnace, and which it may be interesting to point out, the results of my analysis lead to conclusions identical with those I before obtained.

The blast furnace at Seraing, on which I have since experimented, is of very large dimensions. It is 16 metres high, and produces 17,000 kilogrammes (about 17 tons) of cast iron daily. The gases were drawn off at six different heights. I obtained on analysis, results exactly in accordance with those furnished by the coke furnaces of Vienne and Pont-l'Eveque.

In conclusion, my last researches appear to confirm most completely the results furnished by a totally different method of analysis, and to verify the conclusions which I have deduced on the theory of blast furnaces.

* Paris Academy of Sciences.

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ON THE COMPOSITION OF THE GASES PRODUCED IN THE CARBONISATION OF COAL IN OVENS.*

BY M. EBELMEN.

Whilst at Seraing, I had an opportunity of examining the process of carbonisation; I collected the gases evolved at different periods of the operation, in the hope that their analysis might furnish some indications of the manner in which the carbonisation is effected. Whether, for instance, the air introduced in small quantity into the coke oven combines, in preference, with the coke, or with the products of the distillation of the coal; whether the oxygen became converted into carbonic acid or into carbonic oxide.

I found in comparing the composition of the gases with those of coal—1. That more than two-thirds of the hydrogen contained in the coal are burnt during combustion, the remainder being found in the resulting gases. 2. That the proportion of carbonic acid furnished is, on an average, three times greater than that of carbonic oxide.

The coking of coal in close vessels is, therefore, effected under influences entirely different from those which act in the carbonisation of wood in heaps. In this case, indeed, the carbonisation is effected chiefly by the heat which is developed from the combustion of one portion of the charcoal already formed. The surplus heat of the coke ovens is employed at Seraing to heat the boiler of the steam engine, which works the blast of the furnaces. A set of ten ovens, producing eighteen tons of coke every twenty-four hours, suffices to heat the boiler of a 48-horse engine.

ON THE QUALITATIVE DETERMINATION OF TIN, ANTIMONY AND ARSENIC.†

BY T. FLEITMANN.

Although analytical chemistry possesses several methods of distinguishing between tin, antimony and arsenic, I am not acquainted with any process by which these three metals, when they occur together, can be recognised with the same ease and quickness as in the case of most other metals. At the same time, the frequent occurrence of these three metals together renders a quick mode of detecting them highly desirable. The following may be viewed as a small contribution towards this object.

With regard to the discrimination of tin and antimony, this is founded on the solubility of metallic tin in strong muriatic acid, and the insolubility of antimonial stains obtained according to Marsh's method in hypochlorite of soda.

When the muriatic solution of the two metals is treated with some metallic zinc, they are both precipitated, the antimony with disengagement of antimoniuretted hydrogen. When the precipitation is made in a small apparatus for the disengagement of hydrogen, the antimony is readily detected by the black stains insoluble in hypochlorite of soda, which it produces upon a piece of porcelain. When subsequently the precipitated metallic powder of tin and antimony is boiled with strong muriatic acid, only tin dissolves, forming protochloride, which, after subsequent dilution with water, is recognised by the brownish-black precipitate produced by sulphuretted hydrogen. Neither of these reactions are modified by the presence of arsenic.

The detection of arsenic when antimony is present is founded upon a remarkable difference which these two metals exhibit towards nascent hydrogen when the latter is disengaged from an alkaline liquid. When a strongly alkaline solution of antimony is heated with metallic zinc, antimony is precipitated simultaneously with a lively disengagement of pure hydrogen, which does not show the slightest reaction of antimoniuretted hydrogen. If, on the contrary, a substance containing arsenic acid is mixed with an excess of potassa and some finely-divided zinc, the hydrogen given off on the application of heat is abundantly charged with arseniuretted hydrogen. The presence of this latter is ascertained most simply by holding a strip of paper dipped in nitrate of silver over the arseniferous mixture of potassa and zinc; with the slightest trace of arsenic the paper is colored distinctly black.

ON SOME DISTINGUISHING REACTIONS OF ARSENICAL AND ANTIMONIAL SPOTS.*

BY J. W. SLATER.

If a drop of bromine is placed on a saucer, and a capsule containing arsenical spots inverted over it, the spots take a very bright lemon-yellow tinge in a short time. Antimonial spots, under the same circumstances, are acted on much more rapidly (in about five seconds at a temperature of 52° F.), and assume an orange shade. Both become

* Paris Academy of Sciences.

† Liebig's *Annalen*, January, 1851.

* *Chemical Gazette*, February 1, 1851.

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colorless if exposed to the air, and are again restored if treated with a strong solution of sulphuretted hydrogen. The secondary yellow of the arsenical spots, as observed by Lassaigne, disappears on the addition of ammonia, whilst that of antimonial spots remains untouched. A concentrated solution of iodate of potassa turns arsenical spots of a cinnamon-red, and dissolves them almost immediately. On antimonial spots it has no visible action within three or four hours. Solutions of the hypochlorites (chlorides) of soda and lime and chlorine water dissolve arsenical spots instantaneously, leaving those of antimony. A concentrated solution of the chlorate of potassa gradually acts upon arsenical spots, but not upon those of antimony. The nitroprusside of potassium, on the other hand, slowly dissolves antimony, producing no perceptible effect upon arsenic. The statement of Bischoff, that arsenical spots, were soluble, antimonial insoluble, in a solution of the chloride of sodium, could not be verified, as, after repeated trials, it was found to leave both not perceptibly affected. The chloride of barium, the hydrochlorate and the sulphite of ammonia, afforded likewise no distinguishing action. The nitrate of ammonia dissolves arsenical more rapidly than antimonial stains. Of these reactions the most decisive are those of iodate of potassa, hypochlorites of soda and lime, and fresh chlorine water.

Mech. Institution, Droylsden,
Manchester, Jan. 16, 1851.

CHEAP GALVANIC BATTERY.*

BY M. REINSCH.

THE batteries of zinc and platinum, which are so powerful in their action, possess one great inconvenience, viz., that after having been some six or eight hours in use, the zinc becomes coated with sulphate, and the power of the battery becomes consequently much diminished. Charcoal cylinders are most useful in this case, but these are very readily broken, are expensive, and absorb a large quantity of nitric acid.

M. Reinsch substitutes coarsely powdered coke for these cylinders. The following is the method he adopts:—In a small ordinary clay mould, capable of containing from thirty to forty grammes of water, he places a piece of coke in which he has previously bored a hole about half an inch in depth. Around this coke he places coarsely powdered coke, from which the finer particles have been sifted; he then moistens this powder with 45 grammes of nitric acid, and lastly presses into the opening a polished piece of iron, having a fine copper wire attached to its upper part, furnished with a small loop or eye. The zinc cylinder is amalgamated, and it has a copper point, intended to be securely fastened to the loop attached to the charcoal pole.

Three of these batteries are sufficient to produce a current capable of decomposing water in an energetic manner. Two are sufficient for gilding and plating purposes.

When the operation is completed, the clay mould is withdrawn from the acid bath, placed in a dry glass with blunt edges, and covered with a plate of glass. These batteries may often be worked for eight days together, without losing much of their strength. When the action of the nitric acid is exhausted, the coke is washed in water, dried, and kept in a dry place ready for use on another occasion. Copper, even when gilded or platinised, does not answer so well to connect the poles of the battery, as it is so readily acted upon. Iron corrodes less quickly, provided that care be taken to put it immediately in connection with a zinc pole, and then to take it out and wash it as soon as the current is broken. These may be kept for several months without any sensible alteration. The batteries above described are equally applicable for electro-magnetic experiments.

* *Patent Journal.*

CERTAIN METHOD OF ASSAYING COPPER BY ELECTRO-CHEMICAL ACTION.*

PROCESS.—A given weight of the ore (as prepared for assaying by the dry way) is dissolved in an acid (*aqua regia* is the best), evaporated nearly to dryness, redissolved in water, filtered, and then treated as the copper solution described a little further on; take 250 grains of the crystallised bisulphate of copper (or half the quantity), which contains exactly 64 grs. of pure copper, dissolve it perfectly, add two or three drops of acid, and place it in an unglazed earthen pot, which will hold 3 fluid ozs.; place this in another, somewhat larger, glazed, in which there is a weak solution of hydrochloric acid. Introduce a copper cylinder (to which a wire is soldered, and whose exact weight is known) in the copper water, and an iron cylinder (with a wire attached in the same manner) in the outer vessel of acid and water. Amalgamate the ends of the wires with nitrate of mercury,

* *Patent Journal.*

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and connect them in a cup of the same metal, or in any way, so that they are in perfect contact. As soon as the circuit is perfected, the operation will commence (which may be known by a slight hissing sound), and will not cease until all the copper is precipitated on the copper cylinder, and which may be effected in the space of from ten to twelve hours; then take out the cylinder, dip it in water, dry and weigh it—its increase in weight will be the per centage of the copper, and in this case (for half the quantity), it will be 32 grs. heavier than it was before. The operation, when completed, can be known by taking one drop out of the solution and placing it on pure gold, or platinum, and touching it with a zinc rod—if no copper be precipitated on the gold, the solution will be free from copper. Thus, then, may every one interested in the produce of copper know the exact per centage of an ore, according to the sample. By the dry assay there is considerable loss, as is proved by "check samples," on many occasions, varying from ½ to ¾ per cent., and yet the miner must sell by the dry assay; and any one connected with the sale of ore knows (especially in those of low produce) what a difference one-half per cent. makes in the price.

ON THE RELATIONS EXISTING BETWEEN CRYSTALLINE FORM, CHEMICAL COMPOSITION, AND THE PHENOMENA OF ROTATORY POLARISATION.*

BY M. L. PASTEUR.

THE simple and remarkable law of crystallography announced by the celebrated mineralogist Haüy, to the effect that the corresponding parts of a crystal are simultaneously and similarly modified, is well known. This is the law of symmetry; but it sometimes happens, and Haüy was aware of the principal examples, that this law is subject to exceptions.

1. For reasons which I have stated in a former communication, it is necessary to divide the hemiedric forms into two classes. When a crystal is hemiedric, we may, in some cases, imagine another crystal, identical with the first in all its respective parts and yet not superposable, much in the same way as the right hand resembles the left, and yet is not superposable. This class of hemiedrics, which may be termed *non-superposable hemiedrics*, is not the only one that can be adduced. The regular tetrahedron and the rhomboid are hemiedric forms, but all regular tetrahedrons are superposable, and all rhomboids of the same angle are so also.

2. In my first communications, so favorably received by the Academy, I showed that there exists a close connection between non-superposable hemiedrics and the phenomena of molecular rotatory polarisation.

3. These points being admitted, a question naturally presents itself to the mind. Do all substances, of which many are now known, which, when in solution, turn the plane of polarisation, belong to the class of hemiedric crystalline forms? On the other hand, does the hemiedric form always indicate the existence of a rotatory property? I allude here to the non-superposable hemiedrics, for these questions are already in part solved with reference to the superposable hemiedrics. It is for the solution of these important questions, which are quite distinct from each other, that I am about to adduce some new observations.

The facts which I have collected this year relate to asparagine, aspartic acid, the combination of glucose with chloride of sodium, and formiate of strontia.

4. On examining attentively the crystalline form of asparagine, I discovered, beyond a doubt, that all the crystals of this substance are hemiedric, and that they belong to the class of non-superposable hemiedrics. It was probable, therefore, that this substance would be found to possess the molecular rotatory property, and experience has proved this to be the case. The rotatory power of asparagine is left-handed when the asparagine is dissolved in water or in alkalis; but, on the contrary, it is right-handed, and to a much greater relative extent, when the asparagine is dissolved in the mineral acids.

5. The relations which connect asparagine and aspartic acid, indicate the probable existence of rotatory properties in the latter. In fact, aspartic acid does deviate the plane of polarisation of a ray of light, and its rotatory power is analogous to that of asparagine.

6. Moreover, the recent researches of chemists having tended to prove that asparagine is the amide of malic acid, I was induced to examine the rotatory power of malic acid and the malates. Experience here again fulfilled my expectations. Malic acid and its salts possess the property of turning the plane of polarisation of a ray of light, and I found that many of the malates belong to the class of non-superposable hemiedrics. But there is one fact to which I wish to allude with reference to

* *Repertoire de Pharmacie.*

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malic acid. This acid resembles in its rotatory power the peculiarities of the right and left-handed tartaric acid; and the discovery of this analogy naturally led to the conclusion that there would be found to be an intimate relation in the dissymmetric molecular arrangement in these acids. It is very probable that there may exist between malic and either right-handed or left-handed tartaric acid, a similar molecular grouping, with such modification as may be caused by the difference in the composition of the acids.

This idea, suggested by the physical properties, of the existence of a similar molecular grouping in malic acid and one of the two tartaric acids, is far from being opposed to the appearances presented in the organism. In vegetables, wherever malic acid is found, tartaric acid is also found, and *vice versa*. Probably nature uses one of these acids for the production of the other. This remark leads even to the supposition that the molecular grouping in question may be common to malic acid and ordinary right-handed tartaric acid, for it is this kind of tartaric acid that is found associated with malic acid in acid fruits. The relations existing between the right and left-handed tartaric acids give importance to these inferences. For, if there exists a dissymetric molecular grouping common to right-handed tartaric and the malic acid of the mountain ash, we may presume, from analogy that there also exists a molecular grouping common to left-handed tartaric acid and a malic acid yet undiscovered, which will be to the malic acid of chemists what left-handed tartaric acid is to right-handed tartaric acid. In other terms, there will be two malic acids, one right-handed, and the other left-handed, just as there are two tartaric acids.

7. I have given, in my former papers, a detailed examination of the crystallised form and rotatory power of the combination of glucose with chloride of sodium. I regret that I cannot here enter into the peculiarities of the crystalline form of this combination. I will only observe that it belongs to the class of non-superposable hemiedrics, that it belongs to the system of the right rhomboidal prism, and that all its crystals, although apparently perfectly transparent and simple, are nevertheless the result of the grouping of several crystals, as in cases of aragonite, sulphate of potassa, &c.

8. The last subject to which I have to refer, is the examination of the crystallisation of formiate of strontia. If we study with care the crystals of formiate of strontia, we find that, in all the crystallisations of this salt, there are always two kinds of crystals, the one right-handed hemiedric, the other left-handed hemiedric, identical, but not superposable. Nevertheless, if we isolate these two salts and dissolve them separately, neither the one nor the other will affect a ray of polarised light. This leads to the supposition that the hemiedrism of formiate of strontia does not depend upon the arrangement of the atoms in the chemical molecule, but on the arrangement of the physical molecules in the entire crystal, in such a manner, that when the crystalline form disappears in the process of solution, there is no longer dissymmetry; just as if an edifice be constructed having a poliedric external form of a non-superposable hemiedric, and this be subsequently destroyed, the original dissymmetric character will not be retained by the separate parts. Moreover, on recrystallising either the right-handed or left-handed crystals of formiate of strontia, each separate kind yields both species of crystals.

We see then that the hemiedric, and even the non-superposable hemiedric form, exists in these crystals without being accompanied by the molecular rotatory property, of which an example is afforded in quartz. If the analogy with quartz were complete, the formiate of strontia would possess the rotatory property in the crystalline state, sometimes turning to the right, and sometimes to the left, like the two varieties of quartz, unless the existence of two optic axes in the formiate should prevent the phenomenon.

I have already noticed a substance having a non-superposable hemiedric form without its being accompanied by the molecular rotatory property: I allude to sulphate of magnesia.

But I must add that formiate of strontia and sulphate of magnesia present peculiarities in their crystalline forms, which would induce me to expect the absence of all rotatory power in these substances, although they belong to the class of non-superposable hemiedrics.

In fact, an examination of the angles of the crystal of formiate of strontia shows that if one of the angles differed only to the extent of one degree seventeen minutes, it would be impossible, by turning the crystals, to distinguish a right-handed from a left-handed crystal, and the hemiedrism of formiate of strontia would become superposable. But up to the present time in all those cases which I have examined, I have never found the rotatory property to co-exist with superposable hemiedrism, and I have strong reasons to believe that it is not possible.

It is very curious that sulphate of mag-

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nesia and the substances isomorphous with it, possess an analogous peculiarity. In fact, the form of these sulphates is a right prism with a rhombic base; having two modifications on the edges parallel to each base, tending to an irregular tetrahedron. This is the non-superposable hemiedrism. But the angle of the prism of these sulphates is from 90° to 91°, and the right rhomboidal prism assimilates closely to the prism with a square base. It follows that the hemiedrism, although strictly non-superposable, is only a few minutes removed from the superposable, which is not at present known to possess the rotatory property.

ON THE COMPOSITION OF THE AIR AT MOSCOW, DURING THE CHOLERA.*

BY MR. LASKOWSKY.

The author made numerous analyses of the air at Moscow, during the last visitation of the cholera. He used Brunner's method,* which consists in bringing, by means of an aspirator, a certain volume of air into a tube containing phosphorus, and accurately closed. The oxygen is absorbed in this tube, whose increase of weight indicates the proportion of this gas, whilst the volume of oil displaced in the aspirator shows the proportion of nitrogen.

From Mr. Laskowsky's experiments it results that the variations of composition observed at Moscow during the epidemic are so insignificant that they must be attributed to imperfections in the method of analysis: and that in all cases the fact announced by Baumgartuer concerning the considerable variations in the proportion of oxygen in the air of Vienna during the cholera of 1831 is controverted by these researches.

* *Annalen der Chemie und Pharmacie.*

* Vide *Annales de Chimie et de Physique*, 3e série, t. iii, p. 176.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE USE OF COLLODION IN PHOTOGRAPHY.*

BY FREDERICK SCOTT ARCHER, ESQ.

The imperfections in paper photography, arising from the uneven texture of the material, however much care may be taken in the manufacture of it, and which from its nature, being a fibrous substance, cannot, I believe, be overcome, has induced me to lay it aside and endeavor to find some other substance more applicable, and meeting the necessary conditions required of it, such as fineness of surface, transparency, and ease of manipulation.

A layer of albumen on glass answers many of these conditions, producing a fine transparent film, but it is difficult to obtain an even coating on the glass plate; it requires careful drying, and is so extremely delicate when damp that it will not bear the slightest handling; besides these objections, the necessity of having a large stock of glass when a number of pictures are to be taken, is much against its general use. My endeavor, therefore, has been to overcome these difficulties, and I find from numerous trials that *Collodion*, when well prepared, is admirably adapted for photographic purposes as a substitute for paper. It presents a perfectly transparent and even surface when poured on glass, and being in some measure tough and elastic, will, when damp, bear handling in several stages of the process.

I will now give a short outline of my mode of using it. The first step in the process is to prepare the solution of collodion. There are several ways of doing this, but I will briefly allude to two.

Pour a quantity (say 1 oz.) of collodion into a bottle containing dry iodide of silver. Shake them well together, and then allow the excess of iodide of silver to settle. The collodion will in this way take up a certain quantity of the silver salt, and become opaque; it should then be transferred to another bottle containing iodide of potassium, to be again well shaken up until the iodide of silver is entirely dissolved, and the solution becomes perfectly transparent.

Or this:—To a solution of iodide of

* Communicated by the Author.

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potassium in spirits of wine add a small quantity of iodide of silver sufficient to saturate the iodide of potassium; let, however, the latter salt be in excess. Add a small quantity of this solution to the collodion, between 5 and 10 grs. by measure to 1 oz. of collodion will be sufficient, and if any of the iodide of silver should precipitate, a small quantity of iodide of potassium must be added to dissolve it. In this way, or by the former mode, the collodion may be prepared.

The next step is to spread this solution evenly on a plate of glass. This can be done by pouring a sufficient quantity on the glass to run in a body freely. When it has entirely covered the glass plate, let the superabundance be drained off at one corner into the bottle again; this operation cannot be done too quickly, for the ether rapidly evaporating would prevent the collodion running evenly over the surface of the plate, from becoming too thick.

The plate is now plunged into a bath of nitrate of silver, allowed to remain there for a few seconds, and then washed in water. (This washing is intended to remove all the ether from the surface of the collodion, which, if allowed to remain, would cause an unevenness in the sensitiveness of the surface, producing streaks or spots.) Immediately after washing, it may be exposed to the action of light for the time necessary to obtain a picture. This picture can be developed either by gallic or pyrogallic acid. If the latter acid be used, a few precautions are necessary, to which I will allude presently. The former acid may be used as a bath, in the ordinary way. After the picture is developed, the film of collodion should be loosened from the edges of the glass plate with a flat glass rod. By doing this, it will easily separate from the plate and can be allowed to float freely in the water bath, previous to being placed in the bath of byposulphite of soda, and then again thoroughly washed.

The drawing can now be mounted on a plate of glass, and when dry can be varnished, to protect it from injury.

If thought more convenient (and, in fact, this mode is the best when pyrogallic acid is used), the film of collodion, after being exposed to light and the image developed, can be removed from the glass plate (leaving the fixing and final washing to be done at leisure) by rolling it up on a glass rod, thus:—Take a sheet of ordinary white wrapping or thick blotting paper (if glazed it will be better), about the same breadth and about one-third longer than the drawing to be removed, soak it in water, and place it with the glazed side in contact with the surface of collodion. Turn the end of the collodion picture over the edge of the paper lying upon it, then place the glass rod just within the edge, and commence rolling it upon the rod; with a little dexterity, this can be accomplished without injuring the drawing. The cylinder thus formed, is easily removed from the glass rod, and can be preserved for any length of time in this state by being kept damp and away from the light, to be finally fixed at some more convenient time. Thus one plate of glass will be sufficient to make any number of drawings upon, the above operations being repeated for each picture.

The plate of glass should be rather larger than the drawings intended to be made upon it, to allow for rough edges, &c. The back of the glass may be ground to get the focus upon, and one side should be formed into a kind of handle to prevent the hand of the operator being near the solution when the glass is in use.

30 grs. of nitrate of silver to 1 oz. of water will be sufficient for the nitrate of silver bath.

3 grs. of pyrogallic acid to 1 oz. of water, to which must be added about 1 drachm of acetic acid.

Between 5 and 10 grs. of nitrate of silver to 1 oz. of water.

The two latter solutions are to be mixed in equal proportions when a picture is to be developed. A wide-mouthed glass measure will be necessary to hold this mixture.

I have found it convenient to have a trough made of gutta percha, the two sides and bottom of which are about ½ inch high and just large enough to hold the glass plate. With this trough the mixed solution can be poured rapidly over the plate, without fear of any being thrown over the edges.

18th February, 1851.

ON GALVANIC SOLDERING.*

BY DR. L. ELSNER.

By the term "galvanic soldering" is understood the junction of two separate pieces of metal by means of metal precipitated by the galvanic current. This experiment of soldering by the wet way has been for some time past recommended in technical journals; while, on the other side, it has been asserted that a union of separate pieces of metals by this means could not be effected. In order to make this matter clear, I instituted the following experiments, the results

* Newton's *Journal*.

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of which speak favorably for galvanic soldering.

For carrying on the experiments, a "bladder apparatus" was made use of. As exciting fluids, there was used, on the one hand, a concentrated solution of sulphate of copper, with an excess of sulphuric acid, which occupied the exterior vessel; on the other, dilute sulphuric acid, which was contained in the inner portion, which is enclosed by a bladder. The block of zinc was plunged into the sulphuric acid, and a plate of copper, parallel with the bottom of the bladder, into the solution of sulphate of copper; both metals, of course, being connected by wires. On the plate of copper, which served as the negative electrode, was laid a ring of stout sheet copper, which was cut through at one point (the distance between the two cut ends might amount to from about the one-fourth to the one-sixth of a line). After several days, during which time the exciting fluids were repeatedly renewed, the space between the cut ends of the ring was found completely filled with precipitated metallic copper. M. Knoblaut, the engraver, had the kindness to file a portion of the ring at the spot in which the ring had been cut; moreover, the magnifying glass showed the homogeneous filling up of the cut portion with coherent solid copper.

A second copper ring was divided into two parts; and the two halves, with their cut surfaces placed in apposition, were subjected to the same galvanic action. After several days, the two half rings were found completely united into one ring at their point of contact by solid precipitated copper. In this instance, also, filing a portion of the ring at one of the former points of contact, showed that this space was completely filled and solidly united by perfectly homogeneous precipitated copper. On examining this spot with the glass, the perfectly homogeneous connexion of the previously-divided portions of the ring was very evident.

A third experiment was made in the following manner:—Two rings of stout sheet copper were so placed directly over each other as to form a cylinder, consisting of the two rings; moreover, the rings were surrounded with a strip of tinfoil, and this was painted over with a solution of wax in oil of turpentine, so that both rings were equally surrounded with a conducting mould. The rings, thus arranged, were laid on the copper plate of the "bladder apparatus," and plunged in the solution of sulphate of copper. After several days, the inner sides of the rings were covered with a deposit of copper, and the points of apposition between both rings filled up with galvanically-precipitated copper. The rings were no longer subjected to galvanic action, as but a moderately thick layer of copper was deposited on their inner sides: notwithstanding which, both rings were united into a completely solid cylinder. As a matter of course, the outer shell of tinfoil was removed before a trial was made of the solidity of the galvanic deposit. It is also to be remarked, that the rings, after being for some time in contact (during the galvanic action) with the plate of copper on which they reposed, were so firmly attached by the precipitated metallic copper as to require some application of force to separate them from it.

From the communication of the results of the foregoing experiments, it may be stated without any hesitation, that galvanic soldering is available to produce a solid connection of separate portions of metal. Hence it follows, that the solid combination of separate moulded portions of metal into one entire form or figure, by means of galvanically-precipitated metal (usually copper), must be practicable. There is reason to believe that a galvanic soldering would be effected by means of concentrated solutions of the salts of gold and silver, as is the case with solutions of the salts of copper. M. Von Hackewitz informed me that he had remarked in his works on a large scale, and also in the galvanic precipitations of silver, that even in these galvanic union of distinct and separate portions had taken place.

In prosecuting the before-mentioned experiments, it was observed, that when the galvanic action was too strong, and also when the current was too powerful, the negative copper electrodes, as well as the plate of copper and the copper rings resting on it, were covered with a dark brown coating (as is well known to be the case under similar circumstances in galvanic gilding). After many fruitless attempts to get rid of this brown coating, it was discovered that it could be easily and perfectly effected by immersing for some seconds, in a mixture of sulphuric and nitric acids, the articles thus coated. This brought out afresh the beautiful red color of the galvanically-precipitated copper; and after the articles were thoroughly washed with water, and again subjected to galvanic action, a fresh precipitation of copper took place.

That galvanic soldering must have a practical application may, in few words, be deduced on theoretical grounds. The articles are electro-negative, while the zinc is positive; consequently they are negative at

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the opposite points of section, *i. e.* subject to the same electric action; therefore, during the electrolytic decomposition of the metallic salt (in the above instance sulphate of copper), the separating electro-positive particles of copper are deposited on both the opposite cut surfaces. Being once deposited on the immersed article, they form with it a homogeneous whole; and they now act negatively on the copper still remaining in the solution, and again metallic copper is precipitated on it. This process will and must continue until the space between the pieces of metal is filled with galvanically-precipitated copper, as is proved by experience; for the space between the opposite cut surfaces becomes smaller and smaller by the deposit on them of the precipitated copper; and when the deposited particles of metal finally come in contact, the former intervening space is completely filled with copper.

As regards the solidity (the degree of cohesion) of the galvanic soldering, it is the same as that of the galvanically-precipitated copper, or in general that of the precipitated metal; moreover, that the cohesion of the precipitated metal is and must be influenced in proportion to the vigor of the galvanic action is self-evident, and precisely the same phenomenon will take place in this case as has been witnessed in galvano-plastic operations.

In the foregoing experiments, the simple or single bladder (diaphragm) apparatus was made use of, although, as far as I know up to this time, any constant element has been employed; but since, by the application of the simple bladder apparatus, the same results have been obtained as by the application of the hydro-electric constant elements, it is a further confirmation of the practical applicability of the galvanic soldering.

M. Philipp states, that when a ring, open at one place, is to be galvanically gilt, no deposit takes place at the ends, but that it is thicker in proportion to its distance from its ends. I have repeated these experiments with bronze rings (of copper and brass), and found that the rings were all over completely and uniformly gilt and silvered, and consequently on the opposite ends of the cut portions, which, agreeably to the theory, could not be otherwise.

MANUFACTURE OF ICE.—DR. GORRIE'S PROCESS.*

Salud, near Havannah, Dec. 27, 1850.

SIR,—I write from this beautiful suburb of the capital of the Antilles to give you an account of an ingenious invention in operation here, with which I have been much interested, because I conceive it is an admirable device for ameliorating the condition of man in warm climates. It is a machine for transforming water, at all natural temperatures, into ice, by simply mechanical agency, or with so slight an adjunction of chemical action that its influence is hardly recognisable. This transformation it effects so rapidly and in such quantities that, it is believed, ice can be furnished at a cost which will enable the humblest member of the community to enjoy it to the full measure of his wants. It is even contemplated that the abundance with this important article may be produced will modify some of the arts as practised in this island, and be the means of introducing others requiring a moderate natural temperature for their successful production. You may judge of the general delight with which a scheme, proposing to place the greatest of luxuries on a level with the necessaries of life, is viewed in a country where an unremitted high temperature is regarded as the greatest of natural evils.

Soon after my arrival here (about a month ago), I became acquainted with the proprietor of this device, and, in addition to many other acts of politeness, was invited by him to witness a trial he was about to make of its capabilities. It was not, however, till yesterday that he had so far overcome the difficulties in putting together a machine, parts of which were made in different places, and in obviating the defects seldom unattached to novelties in mechanics, as to be able and willing to submit it to observation. I paid much attention to an exposition he gave me of the principle which was rendered subservient to the object in view—to his description of the construction and mode of operation of the machine; and send you the results of his explanation, and my subsequent examination.

On entering a house to which I was directed, as containing the machine, I observed two men turning a crank, which worked an oscillating beam, and was obviously connected with other machinery, but which was so hidden from view that I was unable to understand its nature.

The next thing I saw was, that a wooden box, forming a portion of the apparatus, was opened, and a cubic block of ice—a foot in its sides—beautifully

* *Mechanic's Magazine.*

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clear and very solid, was taken from the interior. With an atmospheric temperature above 80° Fahr., this was an interesting spectacle; but of course it afforded no explanation of the manner in which the ice was produced.

Upon the proprietor detaching some portions of the apparatus, consisting of insulating materials used for preserving the cold produced, sufficient of the machine was exposed to view to enable me, aided by a little illustrative description, to understand its construction, and to perceive its whole operation. It is hardly possible to conceive of an invention, promising such valuable results, more simple in theory; or to avoid an expression of surprise that it should be left to this late day to discover it. It must, however, be confessed that this simplicity is confined to theory; for in practice it has been found necessary to make the machinery, by which it is developed, somewhat complex.

To understand this machine, conceive of two vertical pumps, made precisely like steam engines—one of which is adapted to condense atmospheric air, so as to squeeze out of it a portion of its gaseous heat, and the other is constructed to admit of the expansion of the same air connected with the extremities of a beam, common to both, and you will form an idea of all that is indispensable to manufacture ice on this principle. It will be obvious to the slightest reflection, that as the air in expanding becomes a powerful absorber of heat, and will greedily take it from all surrounding bodies, ice might be made by simply immersing the cylinder in which the expansion takes place in water. This process, however, would be too tardy a one for business purposes; and the operation, therefore, is prodigiously accelerated by various adjuncts. In the first place, in order that the free heat of the condensed air may be extinguished, so as to fit it for its highest degree of refrigerative effect, without any loss of time, a pump, connected also with the beam, but bearing a very diminished proportion in size to the air-pump, is made to inject a jet of cold water at and during every stroke of the machine. And so, a similar pump projects its measure of an uncongealable liquid among the expanding air in the other air-pump, so as to furnish it instantly with the caloric of volume, while the liquid itself becomes cooled at the same time from the heat it parts with. This liquid (a strong solution of salts) is withdrawn from a tank, or vessel designed for the accumulation of "cold," into which, after performing its duty in the expanding engine, it is again sent back through the eduction valves. In this tank the ice is manufactured by simply immersing water, placed in metallic vessels, in the liquid; or with the mechanical addition of occasionally breaking up the adhesions of the ice to the sides and bottom of the vessels, so as to present a new surface of water to the action of the external cold. The reservoir of cold, the expanding engine, the injection pump, and, indeed, every part of the apparatus employed in generating or preserving cold, are so thoroughly concealed from sight, and the radiating influence of the external air by insulating chambers, that the processes going on within them are wholly unperceived.

It ought to be mentioned that the condensed air, instead of being transferred directly to the expanding pump, as the above description would imply, passes intermediately into a wrought-iron reservoir, large enough to store a considerable number of cylinder-fulls of air, and, thus any disadvantage from leakage, or the unequal working of the pumps, is obviated.

There are other auxiliaries to the economical and perfect working of the apparatus, both in regard to the consumption of power, and the production of refrigerative effects; but they are not indispensable to the principle, and are not easily explained. Indeed, the entire contrivance presents such an ingenious system of checks and balances, that none but a man well skilled in mechanical science, and endued with a thorough knowledge of the chemical and physical laws of air, under the conditions to which it is subjected, should presume to undertake its construction.

The result of the experiment made here, though conducted upon a very slight knowledge of the principles involved, is, if correctly reported, highly favorable to the usefulness and value of the invention. In comparison with the operation of the somewhat similar invention of our distinguished countryman, Sir John Leslie, it exhibits much more power. With pumps of about 8 inches in diameter, and of 16 inches stroke, condensing and expanding air to and from a tension of three atmospheres, the block of ice I have mentioned, weighing nearly 60 lbs., was produced by the labor of two men in two hours. At this rate, ice

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can be manufactured within any part of the tropics, at a less price than it can be imported. But on a larger scale, and with a cheaper power, the results would be found much more advantageous; and no doubt sufficiently so to enable ice to be sold at a price which would render it, as contended, accessible to the poorest classes.

The machine is claimed to be of Cuban origin; but it is well understood here that it is the invention of Dr. Gorrie, a physician of New Orleans, and is, undoubtedly, a precise counterpart, except in size, to one publicly exhibited in that city about two years ago. It is said that the inventor was directed to the discovery by a desire to employ expanded atmospheric air, simply and directly, as a hygienic and cooling ventilation for dwellings; and no more useful or laudable purpose could be assigned to it. But the attendant investigation of the properties of air, by showing the exact and enormous quantity of heat it absorbs in expanding, taught him that this object could be obtained more advantageously, by directing the principle primarily to the production of ice. To illustrate the application of the principle to both purposes, the machine just alluded to was built, and though, from an ignorant and presumptuous interference with the plan, it was only partially successful, yet it was considered at the time to meet every reasonable expectation, and to justify a further continuance of experiments. Whether anything more has been done with it in the United States I am unable to determine. Perhaps the inventor, with the versatility and fickleness of his class, has turned his attention to some other device, to be in its turn abandoned; or being satisfied with the merit of having made the invention, he is unwilling to encounter the vexation which must attend the pursuit of the pecuniary advantages to be reaped from it. Perhaps, with the equally characteristic sensitiveness of men of genius, he is unwilling to engage in the inevitable struggle which he knows the sordid, avaricious, and dishonest are ever ready to maintain, in order to rob the ingenious of the fruits of their labors. Whatever may be his motives for discontinuing (if he has discontinued) the prosecution of an invention, which is, rightly considered, one of the noblest discoveries of modern times, he is entitled to and will receive the honors due to a benefactor of the human race.

The practicability and utility of this invention being established, it would be difficult to estimate its full value without a minuteness of detail inconsistent with either my limits or my objects. The commercial and social advantages of such a means of moderating the greatest physical evil of hot climates, are too important and obvious to require any extended notice. It would not be so easy to calculate all the consequences which a free use of such an invention would inevitably induce upon the habits and modes of thinking of a people enervated and torpified by a continuous endurance of high natural temperature. As temperature exerts a great influence over human nature, a cheap and abundant production of artificial cold would, no doubt, extend that mental power and physical energy which at present distinguish the temperate zones into the tropics. Countries in which natural causes keep the inhabitants in ignorance and barbarism, may, by its means, become the seats of science and the arts. Again; the greater portion of the diseases of hot climates being dependent upon temperature for their cause, the free diffusion of a production which is generally acknowledged to be an effectual preventive, must increase the salubrity of such climate, and with it change their comparative prosperity. To our wide-spread intertropical colonies, in both the eastern and western hemispheres, the invention would be of immeasurable advantage: and if anything could rescue the latter from the apparently hopeless state of abject poverty and desolation into which they have fallen, it would be a discovery which, like this, is calculated, in its extended application, to revolutionise the habits and renovate the hopes of mankind.

J. P.

FORMULA FOR MANUFACTURE OF SEALING WAX.*

BY M. POTTINGER.

Dark Brown, No. 1.—Venice turpentine, 112 parts; shellac, 210 parts; red ochre, 42 parts; magnesia, &c., 3 parts.

Brown, No. 2.—Venice turpentine, 112 parts; shellac, 196 parts; ochre, 28 parts; colophany, 84 parts; magnesia, &c., 3 parts.

Clear Blue, No. 1.—Venice turpentine,

* *Patent Journal.*

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112 parts; shellac, 210 parts; red ochre, 28 parts; cinnabar, 14 parts; prepared chalk, 14 parts; magnesia, &c., 3 parts.

Clear Blue, No. 2.—Venice turpentine, 112 parts; fine shellac, 196 parts; colophany, 84 parts; ochre, 42 parts; cinnabar, 7 parts; levigated chalk, 28 parts; magnesia, &c., 3 parts.

Deep Blue, No. 1.—Venice turpentine, 84 parts; fine shellac, 196 parts; colophany, 28 parts; mineral blue, 28 parts; magnesia, &c., 3 parts.

Green, No. 1.—Venice turpentine, 58 parts; shellac, 112 parts; colophany, 42 parts; King's yellow, 18 parts; mountain blue (carbonate of copper), 7 parts; magnesia, &c., 3 parts.

Carmine Red, No 1.—Venice turpentine, 56 parts; shellac, 112 parts; colophany, 28 parts; Chinese vermillion, 42 parts; magnesia, &c., 3 parts.

Golden Yellow, No. 1.—Venice turpentine, 112 parts; shellac, 224 parts; 14 leaves of gold; bronze, 14 parts; magnesia, &c., 14 parts.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in rendering canvass and other fabrics and leather waterproof. HENRY CONSTANTINE JENNINGS, of Great Tower Street, London, practical chemist. Patent dated July 22, 1850.

The present improvements are based on the double decomposition of metallic salts by solable soaps. Any salts and soaps may be employed. In carrying his invention into effect, Mr. Jennings dissolves 112 lbs. of soft soap in a copper with from 25 to 30 gallons of water, and while at the boiling heat he adds to this from 56 lbs. to 66 lbs. of sulphate of zinc (white vitriol). The sulphuric acid of the salt combines with the alkali of the soap, and the oxide of the salt combines with its oil or stearine, and forms an insoluble metallic soap, which when cold rises to the surface of the liquor (a solution of sulphate of potassa or soda), and has the appearance of a white hard mass. This is afterwards reboiled, to purify and separate from it any sulphate of potassa or soda which might hang about it. The next step is to take 50 gallons of raw linseed oil, and boil it with 5 lbs. of American pearl-ash or with carbonate of potassa until it assumes a soapy appearance. If the water-proofing preparation is required to be of a very light color, there must now be added about 10 per cent. of the weight of oil, of animal charcoal, and an equal quantity of water. After boiling for about an hour, the oil must be separated, and filtered, to remove the phosphoric acid and phosphate of lime, by which it will be rendered bright and transparent. $2\frac{1}{2}$ lbs. of acetate of lead, 2 lbs. of litharge, 4 lbs. of red lead, and 21 lbs. of black rosin, are now mixed with the oil, boiled for an hour, and well stirred to prevent their subsidence. In this mixture (at boiling heat) is then placed 30 lbs. of the metallic soap, which is well stirred till dissolved, when the addition of two gallons of a solution composed of caoutchouc dissolved in essence of turpentine, in the proportion of 24 ounces to the gallon, completes the process. As soon as the mixture has cooled down to 160° F., or thereabouts, it may be applied with a brush to the canvass or other textile fabric to be water-proofed. Two coats will be found generally sufficient, but a third may, if desired, be applied. Each coat should be allowed to dry before another is laid on. The salts employed give their own peculiar metallic color to the mixture—thus those of lead and zinc produce a white; of iron, a brown; of cobalt, a blue, &c., &c.

For waterproofing leather, the patentee dissolves in raw linseed oil an equal quantity of any metallic soap. The leather is placed in the preparation at a temperature of 225° Fahr., and remains there till it becomes cold, by which time the moisture and air in the pores of the leather will have been displaced by the preparation, which does not at all affect its pliancy. The leather is dried by exposure to the air, and the whole process of saturation and drying do not occupy more than forty-eight hours.

Claim.—The use of metallic soaps produced as above or by any other means of double decomposition or chemical agency, in combination with raw linseed oil, or with linseed oil prepared as above described, and their application to textile fabrics of all kinds, and for rendering leather waterproof. Also the use of animal charcoal by the process described, for decolorating drying oils, by first mixing them with ammonia, or any other of the fixed alkalis. Also, the mode of using raw linseed oil mixed with alkalis and afterwards neutralised by acetate of lead, or any other chemical agent of analogous affinity, and the use of boiled oils or varnishes mixed with metallic soaps, when the smell, color, and appplication of the same permit, as a dressing for canvass, &c.

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Improvements in a mode or modes of preparing certain matters or substances to be used as pigments. LANGSTON SCOTT, of Moorgate Street, London, wine-merchant. Patent dated July 24, 1850.

Mr. Scott's mode of preparation consists mainly in employing a clay retort such as is used in the manufacture of gas, bedded in sand or finely-pulverised pumice or other substance which will not be affected by the heat necessary to vaporise the zinc, and set in masonry over a fire-place properly provided with flues and dampers. The retort has an orifice at each end, one connected with a recess in the masonry for introducing the zinc to be operated on, and the other in communication with a chamber through which the vapors have to pass on their way to the condensing chamber. This chamber terminates at bottom in a receptacle for the heavy oxide, and has an orifice and slide to regulate the admission of air immediately opposite to the exit orifice of the retort. The zinc is placed, in the metallic state, in the before-mentioned recess, which is then closed with bricks, or otherwise, and luted. When melted, the zinc flows down into the retort, from which, on the application of a greater degree of heat, it emerges in the state of vapor. This enters the chamber at the exit end of the retort, comes in contact with the air admitted there, and passes onward through a flue or shoot to the condensing room. It is here condensed, and falls down on the floor, which is made in the shape of a series of funnels, having under each a cask to receive the white zinc which will be in a fit state to be employed as a pigment in the ordinary manner. The patentee prefers to cover the condensing room with a shallow cistern of cold water, and to make also near the top an exit orifice (provided with a screen of wire gauze) so as to ensure a slight draught of air through the room.

Claims.—1. The setting or bedding a clay retort in sand, or other pulverised material, to be employed in the manufacture of white zinc.

2. The mode described of supplying zinc to the retort.

3. The combination of the chamber, flue, or shoot, and method of supplying air, as described.

4. The mode described of collecting the white zinc in a dry state.

Improvements in obtaining, preparing, and applying zinc and other volatile metals, and the oxides thereof; and in the application of zinc or ores containing the same to the preparation or manufacture of certain metals or alloys of metals. WILLIAM EDWARD NEWTON of Chancery Lane, civil engineer. (A communication). Patent dated July 23, 1850.

Claims.—1. An improvement on what is known as the Belgian furnace, for reducing zinc—this improvement consisting in the arrangement of the fire-place or placrs and flue or flues, so that the products of combustion, after giving off their caloric to the retorts in the chamber, instead of passing off at the top, are reverberated by the closed arched roof, and carried downwards and conducted away through openings situated at or near the bottom. Also, the use of the improved furnace described, formed by making the front and rear walls of the retort chamber, in which the retorts are heated, of hexagonal blocks, with central orifices to receive the ends of the retorts—and this whether for reducing zinc or other metals. By these arrangements, not only is the heat more equally diffused, but a much greater number of retorts may be employed.

2. The use of an oven, retort, or muffle, formed of fire-bricks, for reducing the ores of zinc to the state of an oxide, connected with a fire chamber at the side or end of the retort or oven, so that the products of combustion pass through the spaces surrounding the oven, in which oven the metallic fumes are oxidated by the admission of atmospheric air by suitable means.

3. Alloying iron or steel with volatilised zinc, whether obtained from metallic zinc or from any of the ores thereof. This operation is similar to the conversion of iron into steel, and may be performed in the ordinary cementation furnace. Any of the native oxides of zinc, such as the red oxide and "Franklinite," (which latter, however, is more properly an ore of iron), may be employed, as may also the prepared oxides, provided they be free from arsenic, sulphur, or other substance or quality detrimental to iron and steel.

4. The employment of a bag or chamber with porous sides, or of an air-tight chamber provided with a straining or porous bag adapted to its interior, in connection with a blowing or exhausting apparatus, by which the products of the distillation and oxygenation of zinc and other volatile metals may be separated from the accompanying air and gases,—which latter will be forced, or otherwise drawn through the pores of the cloth, and conducted into the air; and the employment of the same apparatus for obtaining the blue or metallic powder of zinc, and the products of the distillation of other volatile metals. Also the use of a condensing

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or collecting pipe slightly elevated at the end, and provided with an aperture for the escape of the gases, or, otherwise, a horizontal condensing or collecting pipe with a smaller ascending pipe at the further extremity to aid in giving a slight draught to the escaping gases.

5. The fabrication and use of the pigments derived from the ores and oxides of zinc, prepared as described, and the admixture of the gray oxide and blue metallic powder of zinc with the pulverised oxides and ores to produce an electro-magnetic effect when applied to metallic surfaces, to protect them from oxidation. The sulphuret, carbonate, and red oxide of zinc, and Franklinite, are the substances here alluded to. Both these latter contain certain portions of oxide of iron and of manganese, but the Franklinite to the greatest extent. When roasted and pulverised, the red oxide produces a rich dark brown, and the Franklinite, with a slight admixture of lamp black, a very good black.

6. The application of Franklinite to the improvements of iron during the process of reduction, and in the refinery and puddling of crude and pig iron, according to the methods described, and also the application of a receiver or collecting chamber in conjunction with an intermediate flue, or a chamber or chambers, or apparatus of the kind described, to prevent the escape of the fumes and vapors of zinc produced during such process.

Improved mode of manufacturing soap. THOMAS DICKASON ROTCH, Esq., of Drumlamford-House, Ayr. (A communication.) Patent dated July 31, 1850.

The nature of this invention consists in the introduction of certain sulphites, bisulphites, and polysulphites into the fatty, resinous, and other compounds undergoing the process of saponification in the manufacture of soap.

When during the saponification bisulphites of soda are to be introduced into the mass, the ordinary soap pan is to be used, and the process conducted in all respects in the usual manner by filling in the caustic lyes and fatty or other matter, in proper proportions, to be converted into soap, and by heating the mass to the proper degree of temperature. When arrived at this point, Mr. Rotch adds twenty parts of bisulphite of soda, dissolved in water, to every 1000 parts of fatty or other matter to be saponified. The process is then continued in the usual way for making soap without any alteration in consequence of the addition of the sulphite of soda. When potassa is to be introduced instead of soda, the proportions differ; he then adds 25 parts of bisulphite of potassa, dissolved in water, to every 1000 parts of fatty or other matter to be saponified; the operation being otherwise conducted in the usual manner when potassas are used. When lime is to be introduced into the saponifying mass, he adds 20 parts of bisulphite of lime to each 1000 parts of fatty or other matter to be saponified—the bisulphite of lime being carefully diluted with water into a kind of milk of lime before it is poured into the mass in the pan; the rest of the operation being conducted in the usual manner.

The patentee proceeds to describe another mode of carrying his invention into effect, which, under some circumstances, is cheaper, and may be preferable to those before described. During the whole of the ordinary process of saponification, he causes a current of sulphurous acid to be continuously passing through the mass of boiling fatty or other matter, in the proportion of $6\frac{440}{1000}$ parts of sulphurous acid to 1000 parts of fatty or other matter, and he accomplishes this by the decomposition of sulphuric acid in an apparatus of peculiar construction, which is particularly described. About 2 lbs. of charcoal being introduced into this apparatus, with about 20 lbs. of sulphuric acid, at 66° of Baumè, heat is applied till the decomposition of the sulphuric acid is effected, the fire being kept up during the whole process of saponification.

Claim.—The introduction of suitable sulphites, bisulphites, and polysulphites into the saponifying masses of fatty or other matter, as before described.

Improvements in coating and impregnating metals and metallic articles. JOSEPH STEELE, of Chancery-lane. (A communication.) Patent dated August 9, 1850.

Claims.—1. The coating and impregnating metals and metallic articles with a solution composed of the different ingredients mentioned (whose proportions may, however, be slightly varied), and worked in conjunction with a current of electricity, so as to give to such metals or metallic articles the appearance of tin.

The bath alluded to is composed as follows:—75 gallons of distilled water are placed in a non-metallic trough, and heated by steam to about 15° Fahr. above the common temperature; 60 lbs. of common soda are dissolved in a separate vessel with some of the hot distilled water, and strained through a hair sieve into the trough; 15 lbs. of Russian or American potassa are next dissolved in some of the warm solution, and

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strained through a sieve into the trough, after which there is added 5 lbs. of caustic potassa, also previously dissolved in some of the warm liquor of the bath. Two ounces of cyanide of potassium, two ounces of acetate of zinc (dissolved separately in some of the warm solution), and 16 lbs. of binoxide of tin, complete the bath, which will be ready for use when it has stood for two or three hours. If a crust or dirt should rise, more alkali must be added, and if the bath should assume a reddish tinge, sulphate of zinc. The articles to be coated are immersed in the bath at a heat of 25° above the ordinary temperature, care being taken that they are previously well cleansed. One pole of an electric battery is to be in connection with the article, and the other with an electrode of pure tin or zinc suspended in the solution. The former is preferred, as it gives a whiter deposit.

2. The coating of metals and metallic articles with a solution of brass and copper in conjunction with a current of electricity, and the giving to their surfaces, when coated with either of these solutions, a coat of bronze, as described.

This bath is composed of 6 gallons of distilled water, heated as before; 2¼ lbs. of American potassa, dissolved separately in some of the water, and passed through a sieve into the bath; 2½ ozs. of powdered acetate of copper, mixed separately with half a pint of strong spirits of ammonia, 4 to 5 ozs. of sulphate of zinc, and 2 ozs. of cyanide of potassium. This bath is ready for immediate use, but it is preferred to allow it to remain quiescent for three or four days. The sulphate of zinc is omitted from the copper bath. The articles to be immersed must be previously well cleansed from grease and dirt. The battery which the patentee prefers, is that known in Belgium and France as the "Maheux battery." A brown bronze for articles coated with either the brass or copper solution, is composed of three-fourths of a pint of water, the same quantity of sulphuretted ammonia, 2 ozs. of red coloring matter, with French chalk and black lead, according to the color required, mixed up like paint, and applied with a brush. For green bronze, like quantities of water, sulphuretted ammonia, and Prussian blue and chrome yellow at the discretion of the operator.

3. The coating of metals and metallic articles with gold, in conjunction with a small electrode of zinc or copper, to give to such metals and metallic articles the appearance of gold.

This process is conducted as follows:—1 oz. of gold is dissolved in 8 ozs. of nitric acid and 4 ozs. of hydrochloric acid over a spirit lamp, and heat is applied until the acids have evaporated. 24 ozs. of prussiate of potassa and 12 ozs. of carbonate of potassa are placed by degrees in a red-hot crucible, and, when melted, poured into an open earthenware dish. The vitrified potassas are then boiled for about five minutes, with two to three gallons of water, in an enamelled iron pot. This mixture is next filtered, and the filtered water used to wash out all the dissolved gold from the vessel in which it was placed; the whole is then boiled for about fifteen minutes, and again filtered. The articles to be coated are immersed in this liquor at 20° to 25° Fahr. above the ordinary temperature, in contact with an electrode of zinc or copper, by which the deposition is effected. If a darker color than that of pure gold be required, it may be obtained by dissolving with the gold a few pennyweights of copper.

4. The coating of metals and metallic articles with silver, in conjunction with a small electrode of zinc, for giving to such metals or metallic articles the appearance of silver.

In carrying this part of the invention into effect, it is preferred to dissolve over a spirit lamp 4 ozs. of silver in 20 ozs. of nitric acid 1½ lbs. of muriate of *sodium* (query? soda)—common salt, is dissolved in a gallon and a half of water, and added to the silver solution. When the silver is precipitated, the liquor must be poured off, and the precipitate washed till free from the salt and acid. A solution of prussiate and carbonate of potassa, as in the preceding case, is then prepared, and the silver precipitate boiled in it for about fifteen minutes. After filtration, the articles to be coated are immersed in this bath, in contact with an electrode or strip of zinc, and deposition ensues as in the preceding instance.

Improvements in the manufacture of artificial marble and stone, and in treating marble and stone. SELIM RICHARD ST. CLAIR MASSIAH, of Alderman's-walk, New Broad-street. Patent dated August 10, 1850.

Mr. Massiah first takes gypsum, sulphate of lime, or alabaster, cuts it of the desired shape, and submits it to a heat of from 80° to 150° Fahr. until perfectly dry. Secondly. The article is immersed in a warm solution of one pound of borax and a quarter of an ounce of sal-enixum to the gallon of water, and then taken out and dried. Thirdly. It is heated to 250° Fahr. and upwards, until the watery particles are entirely driven off; after which it is allowed to cool until the

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hand can be borne on it for a second or two, and again immersed in a hot saturated solution of borax with concentrated nitric acid, in the proportion of a quarter of an ounce to an ounce to each gallon of solution. It is necessary that great attention should be given to obtaining the best and most highly concentrated nitric acid, as upon this depends, in a great measure, the quality and hardness of the marble. The article should be allowed to remain in this solution until completely saturated, when it should be taken out and allowed to dry. Fourthly. At the expiration of a day or two the article is to be gently heated, and to have Canada balsam diluted with turpentine or naphtha, applied to its surface. It should then be heated, or exposed to the air, to evaporate the spirit.

The above method of procedure is to be followed when plain marbles are required. If it is desired to produce a colored marble, a suitable coloring matter must be introduced into the solution of borax with either nitric acid or a nitrate, *e.g.*, indigo and nitrate of iron to produce a blue. Compound colors are produced by multiplying the processes; thus, after a blue color has been obtained as above, the marble may be heated, allowed to cool slightly to prevent decrepitation, and immersed in a solution of borax, nitric acid, and safflower, or any other red dye. The two colors will separate, and present in some parts the appearance of distinct unblended streaks or veins, and in others will be of a purplish tinge.

Other salts, such as alum, may be used in place of sal-enixum, to the use of which Mr. Massiah does not therefore confine himself. He claims the employment of nitric acid in the white and naturally veined marbles, and the mode of obtaining the compound colors, which may be tripled and quadrupled by multiplying the processes. Also the same process when applied to old, inferior, or decrepitating marbles, whereby they are effectually strengthened and dyed.

IMPROVEMENTS IN THE PREPARATION AND BLEACHING OF FLAX.*

BY CHEVALIER CLAUSSEN.

The Specification.

Firstly, my said invention, in so far as respects improvements in bleaching, has reference to the bleaching of all kinds of vegetable productions, and of fabrics or articles composed of such productions, and consists of the following improved processes.

In the usual method of bleaching fabrics, such as calico, the goods are first immersed in a bleaching liquor, (commonly the solution of hypochlorite of lime, the "chloride of lime" of commerce), and then are steeped in a bath of water, acidulated with sulphuric acid. By this plan the chlorine is set free, either in its simple form or in combination with oxygen, (as chlorous or hypochlorous acids), or in chemical union with the hydrogen of the water, (as hydrochloric acid), and is thus either wasted, by its escape, or is rendered injurious to the fabric, by remaining too long in contact with it.

Now, instead of this, I adopt the following process, whereby the whole, or a great portion of the chlorine or chloro-compound, is kept in a combined state, and recovered for future use. By the term "*chloro-compound*," I do not mean a *salt containing "chlorine,"* but an acid having "chlorine" for its base, such as chlorous or hypochlorous acids.

In this process, then, of bleaching, I take the goods, after they have passed through the bleaching liquor, (say a solution of the hypochlorite of lime), and then steep them in a strong solution of some salt, whose acid has a more powerful affinity for lime than hypochlorous acid; thus a strong solution of sulphate of magnesia may be employed, the sulphuric acid of which, having a strong affinity for lime, combines with the earthy base of the bleaching salt above mentioned, and forms sulphate of lime, and the chloro-compound being thus liberated, unites with the magnesia of the sulphate of magnesia, and forms a new salt (hypochlorite of magnesia), having bleaching properties similar to the lime salt first employed.

This newly-formed compound may be, in the next instance, used as a *primary bleaching agent*, and may again be subjected to the process of double decomposition, as in the foregoing example. Thus, the goods having been exposed to the action of hypochlorite of magnesia in solution, may then be steeped in a liquid holding in solution some carbonate or other salt, for whose base the hypochlorous acid has a greater affinity than for the magnesia. In such a case, the carbonic acid having also a strong attraction for the magnesia, combines with it to form a carbonate of that earth, and the liberated chloro-compound, instead of escaping, or remaining so long in contact with the goods as to injure them, combines with the base of the carbonate employed to produce decomposition, and forms a new

* *Mechanic's Magazine*, Feb. 22, 1851.

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salt having bleaching properties. This salt may also be brought under the same laws of double decomposition, as exemplified before, and with similar results. Thus, if the carbonate employed in the foregoing instance had been carbonate of barytes, and a solution of sulphate of magnesia or of lime were brought into contact with the resulting chloro-compound salt of barytes, a precipitate of the base as a sulphate of barytes will take place, and the chloro-compound will unite with the lime or magnesia to form a bleaching salt.

I would mention, however, that, in bleaching flax, or other like vegetable material for making linen, no compounds should be used which are likely, during their decomposition, to evolve any gaseous matters such as carbonic acid, or chlorine; as, by their development and expansion in the fibrous tubes, the flax, or any similar material, would be rendered not so fit for spinning with the ordinary flax-spinning machinery; but in bleaching flax, or any similar material which is to be combined with other materials for spinning and felting according to my invention, compounds evolving gas may be safely used, as I shall hereafter more fully specify and explain.

For the purpose of bleaching by the method of double decomposition, I do not confine myself to the compounds already mentioned as examples, nor to any particular salts or class of salts; but I claim a right to use any which, when placed under the like circumstances, as before exemplified in the case of goods treated by the hypochlorite of lime and the sulphate of magnesia, will be subject to the same chemical law of decomposition, and will produce the same result.

However, I may particularise as among the salts suitable for decomposing the chloro-compound salts, or assisting themselves in the process of bleaching, the carbonates, such as the carbonate or bicarbonate of soda, sulphates, as sulphate of magnesia, &c., nitrates, as nitrate of soda, &c., acetates, as acetate of potassa and of lead, &c., prussiates, as prussiate of potassa, &c., chromates, as chromate and bichromate of potassa, &c., tartrates, as tartrate and bitartrate of potassa, &c.; but I repeat, that I do not confine myself to these, which are merely given as examples.

Another mode of bleaching which I sometimes employ, and which is especially applicable to goods composed of both animal and vegetable fibres, is as follows:—I take the goods, after they have been steeped in any of the ordinary bleaching liquors, such as the solution of hypochlorite of lime (chloride of lime), and while they are still wet I expose them to the fumes of sulphur, slowly burning in a suitable chamber or stove. In this case, I have two powerful bleaching agents at work, viz., the hypochlorite compound and the sulphurous acid produced by the combustion of the sulphur. A portion of the sulphurous acid combines with the base of the chloro-compound salt, to form a sulphite of lime or magnesia, as the case may be, and a small portion of sulphuric acid may also in this case be formed, which, with the earth or base, would form a sulphate. In this way the chlorine, or chloro-compound, remaining in the wetted goods is liberated, and allowed to act freely upon the articles to be bleached. In this last method of bleaching I have ascertained that there may be occasionally substituted for the ordinary and known bleaching liquids, certain chromates, manganates, and hypermanganates, &c.

Secondly. My improvements in the preparation of materials for spinning and felting have special relation to flax and hemp, and other plants to which the same may be applicable; and the processes I use to prepare the same, though possessed of some features common to the whole, vary according to the purposes to which the fibre obtained from the said materials is to be applied—that is to say, according as the fibre is required to be long or short, fine or coarse, and the machinery in which it is to be spun is adapted to the spinning of one or other sort of fibre.

By the term "*fibre*," as used throughout the specification, I mean that portion of each plant which is capable of being spun or felted; and my invention applies to the "fibre" surrounding the stems of dicotylidenous plants, and to that existing in the stems and leaves of monocotylidenous plants.

In the following exemplifications of my improved modes of preparation, I shall throughout suppose flax or hemp to be the material operated upon.

If I have to deal with the plant from the time of its first being cut down or pulled for use, I take it in the state of straw, after the seed has been stripped from it, and subject it to the following, which I shall call my "primary process:"—

I first steep the straw in a solution of a caustic alkali of about one degree of Twaddel's hydrometer, and for such a length of time as may be most convenient. If despatch is required, I use the solution in a boiling state; in which case an immersion of about six hours is sufficient. If more time can be conveniently allowed, I employ

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a solution of a temperature of about 150° Fahrenheit, and prolong the immersion for about twelve hours; and so in proportion to the degree of temperature. The solution may be even used at a lower temperature, with a corresponding prolongation of time, but in no case need the immersion exceed a couple of days at the utmost.

The object of the preceding treatment is twofold:—First, to decompose, dissolve, or remove, more or less, as required, the glutinous, gummy, or other matters which connect the fibre with the woody portions of the plant, and, second, to discharge or decompose any oleaginous, coloring, or extraneous matter contained in the straw, without allowing the matters so discharged to stain the fibre; and these results are obtained by the action of the alkaline solution.

In the preceding mode of preparing vegetable materials, I generally use a solution of caustic soda; but other alkaline liquors will answer the purpose,—such as a solution of caustic potassa, or of lime dissolved in or diffused in water; or, indeed, any substance having the like power of removing, discharging, or decomposing the coloring, glutinous, gummy, or other foreign matters contained in the straw, and which would interfere with the whiteness of the fibre, or with its ready separation and manufacture.

If the fibre is required to be long, like that now commonly spun in flax machinery, I subject the straw to a second process, for the purpose of getting rid of any of the alkali still adhering to the straw or fibre, and for the purpose of completing, if necessary, the removal of any glutinous, gummy, coloring, or extraneous matters.

To this end I take the straw from the alkaline solution, and steep it for about two hours in water acidulated by sulphuric acid, in the proportion of about one part of the acid to from two to five hundred parts of water. Some other dilute acids will also answer this purpose, such as dilute muriatic acid, &c., but sulphuric acid is to be preferred. Or, I transfer the straw, while yet wet with the alkaline solution, to a suitable chamber or stove, where I subject it to the action of sulphurous acid, or the fumes produced by the slow combustion of sulphur. In both cases the acid combines with any free alkali, remaining on the straw or fibre, to form a sulphite or sulphate, according to the acid employed, while an excess of either sulphuric or sulphurous acid will complete the decomposition, discharge, or removal of the glutinous, coloring, and other matters.

I next remove the straw from the acid bath, or sulphur-chamber, or stove, and wash or otherwise treat it with water, till all soluble matters are removed.

If the fibre is required to be decolorised, the straw may now be exposed to one of the bleaching processes which I have already described, or to any of the other known bleaching processes. It may then be dried, and made ready for breaking and scutching, by the means ordinarily followed in the manufacture of long flax.

I would mention here that, in some cases, it will be found advantageous to pass the straw between rollers, or to break it roughly or partially, before subjecting it to the process above described, for the purpose of facilitating the action of the chemical agents upon it.

By the aforesaid method, I am enabled to remove from the straw certain matters which water alone cannot discharge. The fibre thus prepared is also freer to heckle, and the straw more easy to scutch, than fibre and straw treated in the ordinary way. Much time and much material are also saved; while the noxious exhalations attendant upon the water-rotting system are wholly prevented.

If the fibre is required to be short, so that it may be felted or carded, and adapted for spinning on cotton, silk, wool, worsted, or tow, spinning machinery, either alone or in combination with cotton, wool, hair, fur, silk, or shoddy, I take the fibre, after treating it by the processes just described, and divide it in proper lengths by some suitable instrument or machine. I then transfer the straw or fibre to a bath containing a strong solution of bicarbonate, sesquicarbonate, or even carbonate of soda, or any other similar compound; but the first two of these are to be preferred, as most abounding in carbonic acid. In this bath I allow it to remain for about three or four hours, during which time the fibre becomes well saturated with the salt. I then immerse the materials impregnated with the solution of the carbonates before named, for about a couple of hours, in water acidulated by sulphuric acid, of about the strength of one part of acid to two hundred parts of water. Or instead thereof, I expose the saturated materials while wet to the action of burning sulphur in a suitable chamber or stove.

In this operation it appears that a certain portion of gas being developed in the fibrous tubes, splits and divides them by its expansive power into filaments, having the character and appearance of fine cotton wool; in which state they may be dyed and manufactured like cotton or wool.

The same means of effecting the splitting of the fibre may of course be employed in

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the preparation of long fibre, and I do not limit myself to its use for the preparation of short fibre alone, but when the fibre is of its original length, the solution employed takes a longer time to penetrate the interior.

The decomposition of the bicarbonate of soda or other suitable compound, with which the fibre is saturated, may be also effected by means of electric agency, when a like evolution of gas and splitting up of the fibre will take place.

After the fibre has been subjected to the splitting process, it must be carefully washed to remove all soluble matters, and then dried.

The splitting process may be applied to the plant either in the straw (the wood of which is to be afterwards removed by proper means and machinery), or in the state of long fibre, whether prepared by my before described process, or by any of the usual and known processes.

Thirdly. My invention, in so far as it relates to improvements in yarns and felts, consists in composing the same of the following new combinations of materials. I manufacture a yarn which I call "flax-cotton yarn," composed partly of flax fibre, prepared and cut into short lengths, as aforesaid, and partly of cotton, varying the proportions at pleasure. This yarn is much stronger than yarn composed of cotton alone, and also much whiter and more glossy, while it is equally capable of being spun in the ordinary cotton-spinning machinery.

I also manufacture yarns, composed in like manner, partly of hemp fibre, or of jute, or of phormium tenax, or of other like vegetable fibre (China grass excepted), prepared and cut into short lengths, as aforesaid, and partly of cotton, which yarns each possess the same properties, more or less, as the flax-cotton yarn.

I manufacture also a yarn, which I call "flax-wool yarn," composed partly of flax prepared and cut into short lengths, as aforesaid, or of any other like vegetable fibre, cotton and China grass excepted; and partly of wool, or of that description of it called "shoddy," or partly of fur or hair, or partly of any two or more of the said materials; which yarn is stronger than any yarn composed of wool alone. Some wools also, which are too short to be spun by themselves, may, by being mixed with flax-fibre, cut into short lengths, form a material very suitable for spinning.

I manufacture also a yarn, composed partly of flax, or other like vegetable fibre, China grass excepted, prepared and cut into short lengths, as aforesaid, and partly of waste silk; that is, silk of the short lengths in which it exists before reeling, or, silk rags cut into short lengths and carded.

Lastly. Flax felts, of a fineness and softness equal to the best felts, composed wholly of wool, and superior to them in point of durability, are also produced by a mixture of flax-fibre, prepared and cut into short lengths, as aforesaid, with wool, fur, hair, or any other feltable material.

And I declare that what I claim as secured to me by the said letters patent, is as follows:—

First. I claim the method of bleaching by double decomposition, before described, whereby the various bleaching agents and compounds used may be recovered and economised.

Second. I claim the method of bleaching by the combined action of chlorides or carbonates, or chromates, or any other bleaching agent, with fumes of sulphur, as before described.

Third. I claim the preparing of flax and hemp, and of all vegetable fibre capable of being spun or felted, from whatever descriptions of plants obtainable, by steeping the plant from which the fibre is derived, while in the state of straw, stem, leaf, or fibre, first in a solution of caustic, soda, or other solution of like properties, and then in a bath of dilute sulphuric, or other acid, as before exemplified and described.

Fourth. I claim the preparing of the said vegetable fibre for spinning in cotton and silk machinery, and for being combined with cotton, wool, raw silk, or other materials of short staple, by firstly steeping the same in a solution of caustic, soda, or other solution of like properties. Secondly, steeping them in a bath of dilute sulphuric, or other suitable acid, or exposing them to the fumes of sulphur. Thirdly, saturating them with a solution of bicarbonate of soda, or any other like agent, and then decomposing such salt, however such decomposition may be effected; and, Fourthly, cutting them up into short lengths, all as before exemplified and described.

Fifth. I claim the employment generally in the preparation of flax, hemp, and other sorts of vegetable fibre, of the mode of splitting by gaseous expansion, as before described, whether the fibre is long or short, and whatever may be the purpose to which the same is to be applied.

Sixth. I claim the manufacture of yarns and felts from a combination of flax, or like vegetable fibre, China grass excepted, prepared and mixed, as aforesaid, with cotton wool, "shoddy," silk waste, fur, and hair, all or any of them, as before exemplified and described.

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III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ON VALERIANIC ACID AND ESSENCE OF VALERIAN.*

BY M. THIRAULT.

After having explained the present state of science as regards the pre-existence of valerianic acid in the roots of valerian and on the formation of this acid by the oxidation of the essence, M. Thirault details the experiments which lead him to affirm that valerianic acid does not pre-exist in valerian root; that it is only the product of the oxidation of the essence; that this oxidation takes place at the expense of the oxygen of the air; that water and the caustic alkalis greatly facilitate this oxidation; that the caustic alkalis at the ordinary temperature have no direct action, and that they do not react chemically on the elements of the essence; that they act in this case only by the property which they possess of forming an intimate mixture with it, and of thus presenting it in a state of perfect division to the action of the oxygen of the air; and, finally, that crude essence of valerian, that is to say, as it is obtained by simple rectification with water, is completely transformed into valerianic acid.

M. Thirault's principal experiment consisted in making a mixture of essence of valerian and hydrate of potassa, dividing it into two proportions, one of which was placed in a stoppered flask, and the other exposed to the air for six months. The portion of mixture kept from the air was unaltered in nature; no valerianic acid was formed in it: the other portion was almost completely deprived of color, and much acid was formed. Six months afterwards, the mixture had acquired the appearance of white honey and was somewhat clotty; in the midst of this crystalline mass were formed other and very bulky crystals of valerianate of potassa. Finally, there was a deliquium of the excess of potassa and valerianate of potassa. He did not find a trace of essence.

The following is the process which I employed for obtaining valerianic acid:—

I boil for two hours about 50 kilogrammes of valerian root, with 6 kilogrammes of caustic ley, and exactly sufficient water to cover the root; I replace the water as it is evaporated; I then leave the whole for one month in contact with the air, taking care to agitate the mixture three or four times a day; at the end of that time, I add sufficient sulphuric acid to neutralise the soda, which I previously estimate. I afterwards fraction the mixture into two parts, so as to be able to submit them to distillation with 250 to 300 quarts of water. It is necessary to collect the water distilled over in a Florentine receiver, in order to separate from it the portions of essence which have not been acidified; this essence may be employed as such, or may be converted into valerianic acid by leaving it to the influence of the oxygen of the air with a solution of caustic potassa; I afterwards saturate the distilled water obtained with carbonate of soda, and after having concentrated it to a syrupy consistence, I introduce it into a very long glass, and add by small portions at a time sufficient sulphuric acid diluted with its own weight of water, to saturate the carbonate of soda employed; after agitating it, I cork the glass and leave it to repose for twenty-four hours: at the end of that time there is found at the upper part of the glass vessel, an oleaginous layer of valerianic acid, and at the lower part a liquid composed of a dilute solution of the same acid and a crystallisation of sulphate of soda; I separate by means of a syphon or funnel with a stop-cock the layer of oleaginous valerianic acid, and, as it is slightly colored, I rectify it if I wish to retain it in the state of valerianic acid; if on the contrary, I intend it for the preparation of a colored valerianate, such as that of iron, I employ it as it is. When too deep a color compels me to rectify it, I distil it with that which is in solution in the lower part of the glass vessel. To separate this solution from the crystals of sulphate of soda which accompany it, I place the whole in a small square of muslin, and I thus collect the sulphate of soda. This mode of previously separating the valerianic acid from the sulphate of soda is very advantageous, for we thus avoid the popping up which always accompanies the distillation when it is operated on the mixture immediately after the decomposition of the valerianate of soda by sulphuric acid and without giving the sulphate of soda time to separate from it by crystallising: the popping up is so great, in operating on the product of 50 kilogrammes of root, that the glass retort is

* *Journal de Pharmacie*, January, 1851.

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very often broken, especially towards the end of the operation.

It is essential not to employ an excess of sulphuric acid to decompose the valerianate of soda; it is even better to leave a small portion undecomposed than to exceed the quantity of acid absolutely necessary for neutralising the carbonate of soda employed: we are then certain that the valerianic acid obtained is free from sulphuric acid, and the formation of sulphurous acid is avoided; for, towards the end of the distillation, a portion of the organic matter is carbonised, and the carbonic acid in excess gives rise to the formation of sulphurous acid.

The valerianic acid obtained by the process which I have just pointed out, boils at the temperature of 266° F.; at 73° F. and under the pressure of 0·763m. its density is about 0·960; subjected to refrigeration at the temperature of 14° F., it becomes a white mass of very little consistence; at 0° F. it congeals completely, and is then retained in the same state until the thermometer stands between 4 and 5. The density of monohydrated valerianic acid, according to MM. Dumas and Stas, being 0·937, and and its boiling point 347° F., it is an acid with 3 equivalents of water which I obtain by the process which I point out. Trommsdorf assigns to trishydrated valerianic acid 269° F. as its boiling-point. It is very easy by simple evaporation to remove two equivalents of water from this acid, and thus to reduce it to the state of monohydrated acid. Indeed, when this trishydrated acid is heated, the thermometer very rapidly rises from 266 to 347° F., the boiling-point of valerianic acid with one equivalent of water.

VALERIANATES.

The valerianates, with the exception of those of oxides of metals of the first section, are very unstable; a slight heat is often sufficient for decomposing them. Some of them may even be decomposed in water by prolonged boiling: such is the decomposition of the valerianate of zinc noticed by M. Leudet. This salt, like the valerianate of peroxide of iron, allows all its acid to be disengaged when it is boiled for some time, and nothing but oxide is found in the place of the salt. I shall say very little concerning the preparation of the valerianates in general: it is well known. They are obtained in two ways:—by the direct way and by double decomposition; but, although it is very easy to prepare them, there are certain circumstances in which preference must be given to one of these processes.

When we employ the process of the direct combination of the acid with the base, it is frequently necessary to have recourse to the employment of alcohol when the base is not soluble in water, as in the case of quinine: the alcohol used in this case may be the cause of the partial or total decomposition of the valerianate when heat is used to dry the salt. I have ascertained that when valerianate of quinine prepared by means of alcohol and submitted to a temperature of 122° to 140° F., it loses almost all its acid as the alcohol evaporates. The salt then becomes completely insoluble in water; treated by a mineral acid, it disengages scarcely perceptible traces of valerianic acid. The same decomposition occurs with the valerianate of morphia; it is doubtless the same with all organic bases which have in general only a very feeble capacity of saturation. The valerianate of quinine might be obtained by treating the base directly with valerianic acid with the aid of water; but this mode of preparation is almost impracticable, quinine being very difficultly attackable by valerianic acid without heat, especially when it is diluted with water; heat must therefore be resorted to; the quinine then resinifies and adheres to the side of the capsule, and a great part of the valerianic acid is volatilised before the combination is effected. In this case, it becomes necessary to add more acid, and, consequently, a much greater quantity of acid is employed than is necessary for forming this salt. The process of preparing this salt to which I have given the preference, is by means of the double decomposition of valerianate of baryta and sulphate of quinine; care must be taken to employ so small a proportion of water that only a very slight evaporation is necessary for rendering the liquid crystallisable. It almost always happens, and especially when it is necessary to concentrate the liquor, that the salt takes two very different crystalline forms; one in small cubic crystals, and the other as a silky or radiated *tuft*. Is this diversity in the crystalline form to be attributed to a state of dimorphism, or are two salts formed, the one neutral or basic, and the other containing an excess of acid?

This second opinion may be admitted if we take account of the facility with which organic bases give up valerianic acid. Indeed during the course of the evaporation which the liquid is made to undergo, a very evident disengagement of acid is manifested, and this disengagement continues all the time that the liquor is left to cool.

Valerianic acid forms two salts with iron, valerianate of the protoxide, and valerianate of the peroxide. The first can be kept only

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in the state of solution, for the least heat and the simple contact of the air are sufficient to make it pass to a higher degree of oxidation. As it is the last of these salts whose employment in therapeutics has been recommended, I turned to account for preparing it the facility with which the salt of the protoxide is converted into that of the peroxide; I then employed with advantage the double decomposition of the valerianate of baryta and the protosulphate of iron. The valerianate of protoxide of iron, which is formed, after having been separated from the sulphate of baryta, is put into a capsule and gently heated; an iridescent pellicle soon appears on the surface, which is removed as fast as it is produced; I dry the salt on sheets of blotting paper, which I place on plates of plaster; in this manner, the desiccation is rapid, and I need not have recourse to heat; it is known that all the valerianate of the protoxide has passed to the state of peroxide when the iridescent layer is no longer formed, and when the liquor which is of the green color peculiar to the protosalts of iron, has become colorless.

This mode of preparation is far preferable to the direct treatment of iron filings by valerianic acid, for there is no action without the aid of heat, and it is consequently necessary to have recourse to it; and even then the action is very slow and entails a very considerable loss of valerianic acid. The same difficulty is found when hydrated peroxide of iron is employed instead of the filings, for the salt formed being insoluble, it is necessary to employ a great excess of valerianic acid in order to be certain that it shall not contain uncombined oxide of iron.

ESSENCE OF VALERIAN.

Contrary to the opinion of several, M. Thirault thinks that essence of valerian pre-exists in the root; the following are the experiments which prove the pre-existence:

1st. He put into a hermetically-sealed flask exactly filled with anhydrous ether, 350 grammes of fresh valerian root, previously incised in the ether in order to prevent the access of air.

2. He likewise filled with great accuracy another hermetically-sealed flask with anhydrous ether, and introduced into it 100 grammes of dry, powdered valerian root.

In the first experiment, the ether was left in contact with the root for three months; the liquid was acid to litmus paper; it left a layer of essence on being evaporated. There was also a little valerianic acid, which had doubtless been formed at the expense of the essence of valerian during the dessiccation of the root.

The roots in both experiments, after having undergone this first treatment, were separately exhausted by more ether, then submitted to distillation with water, and the distilled product had no odor, and did not show with litmus paper any trace of acidity.

It results then, from these experiments, that essence of valerian pre-exists in the root.

That during the dessiccation of the root a small portion of essence is converted into valerianic acid.

Notwithstanding this pre-existence of the essence, it may be admitted that there is some analogy between it and essence of bitter almonds, as to their mode of transformation into acid, since this transformation takes place solely by the oxidising action of the air: the same as we admit a hypothetical radical, benzoile, another hypothetical radical, which we might call valerile, may be admitted.

Valerile..... $C^{10}H^{18}=Vl$

Essence of valerian, or Hydroguret of valerile } $C^{10}H^{18}+H^2=Vl+H^2$

Valerianic acid.... $C^{10}H^{18}O^3+H^2O=VlO^3$

Valerianic acid might be formed from essence of valerian in the same way as benzoïc acid from essence of bitter almonds. If the comparison be pushed further, it is evident that as when benzoate of lime is distilled at 392° F. benzoïn is produced, so, by submitting valerianate of lime to dry distillation, valerone is produced. Valerianic and benzoïc acids likewise lose an atom of carbonic acid and an atom of water.

Notwithstanding this similarity of formation and decomposition between valerianic acid and benzoïc acid, the essences of valerian and bitter almonds do not resemble each other; they differ entirely in the modifications which they may undergo when they are submitted in identical circumstances to chemical or physical influences.

Crude essence of valerian, that is to say, that which is obtained by rectification with water, has a greenish color; its odor resembles that of valerian root; its density, at the temperature of 73° F. and under the pressure of 0·763m, is 0·935; it boils at 347° F.; at this degree of temperature, it loses its primitive color and becomes of an amber yellow. Exposed to the cold of —24, it is not separated into stearopten and oleopten; it retains its transparency and fluidity. Neither liquid ammonia nor ammoniacal gas appear to act on it; chlorine, on the contrary, does seem to act upon it, for when a current of this gas is driven for a long time into the essence, hydrochloric acid is formed. Pure sulphuric acid dis-

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solves the essence of valerian, taking a very intense red color; there is a very great elevation of temperature. Nitric acid of the density of 38° likewise dissolves it, forming a violet color. There is no disengagement of nitrous vapors: as in the treatment by sulphuric acid, when the nitric acid is saturated by a dilute solution of carbonate of soda, an essence floats which resembles essence of turpentine in odor.

When essence of valerian is treated by monohydrated nitric acid, the reaction is very brisk; care must be taken to add the acid drop by drop, in order to avoid the matter being thrown out: there is such an elevation of temperature, that combustion takes place: on each fresh addition of acid, the mixture takes fire, and nitrous vapors are abundantly disengaged; the essence is finally completely dissolved, acquiring a brown tint. If water be then added, there rises to the surface a resin of an amber-yellow color, of demisolid consistence and capable of being malaxated like a plastic mass. After several washings, it is finally precipitated to the bottom of the water. This resin dissolves in alcohol and ether; caustic potassa and ammonia likewise dissolve it, the first coloring it brown, and the second communicating to it a very intense red. When these alkalis are afterwards saturated by a mineral acid, the resin is reproduced with its original properties.

When in particular it is subjected to the action of heat, it is profoundly altered, and, according to the degree of temperature, new products are formed MM. Gerhardt and Cahours extracted two products from it; one, valerole, and the other, borneëne, which differs from the solid camphor of Borneo only by an atom of water which may easily be removed from it by means of anhydrous phosphoric acid, producing a hydrocarbon which M. Dumas has called camphogen.

From the study which he has made of the distillation of the essence of valerian, M. Thirault is led to believe that the foregoing products do not arise from the essence, but that they are on the contrary the results of a more or less profound modification which the elements of the essence undergo. Indeed, placed in favorable circumstances, essence of valerian, without the influence of chemical action, may furnish a great quantity of valerianic acid, which can scarcely be attributed to the transformation of the valerol pre-existing in the essence. For this body itself left in contact with the air furnished very little valerianic acid; on the contrary, it is in great part converted into resin; to convert it completely into valerianic acid, the aid of the energetic action of caustic potassa in the state of fusion is required: there is thus formed, besides valerianic acid, carbonic acid and hydrogen; which renders it very probable that valerol does not pre-exist in the essence, but that it is formed when we subject this essence to the action of heat. Borneëne does not pre-exist either: it is one of the first products which are formed when essence of valerian is submitted to a moderate temperature; this product is isomeric with essence of turpentine; essence of valerian itself is isomeric with the hydrate of turpentine of MM. Blanchel and Sell; may we not admit, since ordinary sulphuric and nitric acids transform essence of valerian into essence of turpentine, that to this dishydration may be attributed this transformation?

PRESENCE OF LEAD IN THE BRAIN AND LIVER.*

BY MM. AD. CHATIN AND BONVIER.

BEING desirous of arriving at an opinion on a still controverted point of medical science, we determined on looking for lead in the brain of a man who had died just after leaving a white-lead manufactory. In order to perform the analysis in such a way as to leave nothing to be desired, and having regard to the very small quantity of lead that the brain could contain, we operated first on the liver.

LIVER.—300 grammes were cut into small pieces, and boiled for two hours with 2000 grammes of water acidulated with one-tenth of pyroligneous acid. The solution having been evaporated and carbonised with a little nitric acid, the charcoal was treated with boiling distilled water acidulated with one-twentieth of nitric acid. After having driven off the excess of acid from the nitric solution by concentration, we submitted it to a current of sulphuretted hydrogen which caused an abundant black precipitate. Redissolved in boiling nitric acid, this precipitate ultimately furnished a nearly pure solution of lead, which, freed from acid and reduced to 10 grammes, gave the following reactions:—

With sulphuretted hydrogen, a black precipitate;

With sulphate of soda, a white precipitate;

With ferrocyanide of potassium, a white precipitate;

With iodide of potassium, a yellow precipitate.

* *Journal de Chimie et de Pharmacie*, February, 1851.

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BRAIN.—Half of the encephalic mass was submitted to the foregoing treatment; only the solution to be put in contact with the reagents was reduced to one gramme, on account of the very small quantity of lead found by operating with sulphuretted hydrogen gas. The following are the reactions:—

Sulphuretted hydrogen, brown-black precipitate;

Sulphate of soda, light white precipitate after a short time;

Ferrocyanide of potassium, light white precipitate after a short time;

Iodide of potassium, very light yellow deposit after a few hours.

From these experiments it results that the brain, and especially the liver, contained lead; and if it be considered that iodide of lead is soluble in 1000 or 1200 parts of cold water, it may be considered that the 300 grammes of liver contained half a centigramme (0·005) and the brain half a milligramme (0·0005) of this iodide. The chemical equivalents of lead (1294·5, oxygen=100) and of iodine (1579, oxygen=100) show, moreover, that the metal constitutes nearly half the weight of the iodide.

The process which we have followed being that which M. Orfila recommends for detecting lead in cases of poisoning, to the exclusion of normal lead, these researches prove that we may extract from the brain of workers in white lead, who die suddenly of saturnine encephalopathy, an appreciable trace of the agent which caused their death.

[SOME contradictory statements having appeared in the medical journals respecting the use of glycerine in the treatment of deafness, we quote from our respected contemporary, *The Lancet* (January 18, 1851), the following clinical lecture.]

ON THE USE OF GLYCERINE IN THE TREATMENT OF CERTAIN FORMS OF DEAFNESS.

A CLINICAL LECTURE DELIVERED BY THOMAS H. WAKLEY, ESQ., F.R.C.S., SURGEON TO THE ROYAL FREE HOSPITAL.

(*Reported by* MR. W. TYNDAL ROBERTSON, *Resident Surgeon.*)

NEARLY two years have now elapsed since I published in *The Lancet** a paper on the Use of Glycerine in the Treatment of Certain Forms of Deafness. Numerous facts justified that publication. I did not rush into print hastily, and without due consideration. Tried by the severe and scrutinising test of experience, glycerine now takes its place amongst the most useful of our remedial agents, in the treatment of several common varieties of deafness. Speculation on the subject is at an end: indisputable facts constitute the data whence the opinions favorable to glycerine have been formed.

The peculiar chemical properties of this fluid have led to its use in other complaints besides deafness, and in some with signal advantage. But the results of its use in affections of the ear have been even more satisfactory than were anticipated. In the hands of several surgeons, the remedy has been used with undoubted benefit; still, its successful employment often demands much care and patience.

I must enforce the "oft-told tale," that an accurate diagnosis is half the cure. With equal truth it may be stated, that the indiscriminate use of a remedy is calculated to bring many a valuable medicine into disrepute. The surgeon who would successfully resist morbid action, of whatsoever kind, must patiently investigate the character of the malady, before he decides upon the plan of treatment; otherwise much perplexity will ensue, and the intended antidote may become the actual poison.

A new remedy is sure to be exposed to the misfortune of being recommended in cases that are not suitable for its adoption: from this cause an important agent often falls into disrepute, and even disuse. In the treatment of deafness, failures of new remedies are the more likely to happen, as aural maladies find no favour with the majority of the profession. Many empirics owe all their success and ill-acquired wealth to this cause.

The introduction of *Glycerine* into the treatment of ear-diseases has produced some slight change in practice; and many cases, which not long since fell to the lot of the "aurists," are now in the hands of regular practitioners, greatly to the advantage and safety of the sufferers. The examination of the ears by competent practitioners has led to the discovery of diseases unsuited for the use of glycerine, but having fallen under the notice of competent surgeons, unexpected relief has been afforded to many desponding patients. Why, it may be asked, should the surgeon abandon any class of diseases, and thus invite the charlatan to enter a field of practice which legitimately belongs to the profession? The impropriety of so doing cannot be doubted. It is improper,

* Vol. i. 1849, p. 664.

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because it is injurious to the professional character; and it is unwise, because it encourages ignorance, at the expense of a too credulous public.

Soon after my first publication, many unsuccessful cases of the employment of glycerine in deafness were reported to me. This was to be expected. Failures were sure to take place, from a variety of causes; the two most frequent being, the inaptitude of the cases chosen for the employment of glycerine, and the impurity of the drug used. Several samples of glycerine were sent to me for examination. In only one instance was the specific gravity correct, and in several the fluid contained an admixture of lead and oil; such glycerine as this must always prove injurious. Sometimes it may, when thus impure, prove highly irritating, and instances of this kind have been mentioned to me by both London and country practitioners. If there exist oily particles in the glycerine they become rancid, and the whole fluid is speedily vitiated: in this state it cannot be used with safety. I feel confident that the impurity of the article has been a frequent cause of failure. In other instances, the glycerine has not been used with sufficient diligence, nor for the requisite length of time. Structures that are almost disorganised cannot be restored to a normal state in a day.

The glycerine has now been employed in some hundreds of instances of deafness, and data have been collected that indicate the cases in which the remedy should be used, the duration of the treatment, and the probable or possible permanence of the cure. In prescribing the use of glycerine, care should be taken to discriminate between those diseases which are suitable for its employment, and others where the remedy would be introduced without the slightest prospect of advantage. In making this investigation and inquiry, the *history* of the malady cannot be too attentively considered. Did the defective hearing first occur after an eruptive fever?—an abcess in the face, or fauces?—a fall?—a blow?—a fit? Was there a discharge from the ear in the first instance?—if so, what was the character of the discharge? Did any sequestra escape? The *form* of the ear should be carefully examined, and the auditory canal and membrana tympani inspected by means of instruments especially constructed for the purpose. A silver speculum should be used, through which are reflected the rays of the sun, or of a very strong artificial light. By these means we are enabled to examine carefully the auditory cul-de-sac, and especially the membrana tympani. The quantity and condition of the cerumen should be ascertained. If a stethescope be placed over the external ear, and the patient be directed to close his mouth and nostrils, and then forcibly expel the air from his lungs, it will readily be discovered whether the Eustachian tube be open or not.

If the drum be entire, the air will be heard to strike forcibly against it. On the other hand, if the drum be perforated, the escape of air through the auditory passage, will truly indicate the condition of the parts. All these points are entitled to attention; some of them, however, as you will soon discover in practice, are of much more importance than others. Catheterism of the Eustachian tube should not be practised on slight grounds. When a necessity for the operation exists, of course it should be performed, but not otherwise. In unpractised hands the operation may be productive, not only of annoyance, but of some mischief.

If the surface of the auditory canal be hard and inelastic, shining, and of a whitish appearance; if the natural secretion be wanting, and the membrana tympani be not painful to the touch, the glycerine may be employed with a tolerable certainty of success, even if a partial deafness has been of many years' duration. An uneven appearance of the external membrane of the drum is an unfavorable sign, as in some instances it may be caused by displacement of the bones of the delicate aural structure. When besides the sense of hearing, the other senses are deficient of action, the employment of glycerine alone offers no hope of success. In such cases the utmost possible attention should be paid to the general health of the patient, with a view to restore the activity of the nervous system. The existence of paralysis in any part, unless from a traumatic cause, is an adverse indication with respect to the use of glycerine. The modes of applying the remedy vary according to the state of the parts, and the effects sought to be produced. When the surface of the aural canal is dry and shining, the ears are to be carefully cleansed by means of cotton held within the blades of a pair of forceps, and moistened with warm water. The canal is then to be rubbed with dry cotton, held in a like manner. Next the glycerine is to be applied by the same means, the cotton, well soaked in it, having been repeatedly passed backwards and forwards in the external meatus, care being taken to diffuse it over the surface of the tympanum.

I shall now mention some cases, selected from my note-book, as furnishing good types of the diseases which have been

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relieved by this mode of applying glycerine. They might be multiplied to a very large number.

Mary R——, Gray's-inn-lane; Nov. 19, 1850; aged forty-nine; a strong, healthy-looking woman, an out-patient of this hospital. Deaf six years; could not hear the highest power of sonometer; ears dry and horny; membrana tympani of the right side ulcerated after a discharge (following scarlet fever), lasting six months; in the other ear the membrane was sound. The ears were rubbed with glycerine in the usual way, and in a few days she heard successively Nos. 8 and 7 of the sonometer. In seven weeks she was quite cured, a healthy secretion of wax having been established.

Anne M——, Gray's-inn-lane; aged thirty-three; a spare, thin woman; had been deaf since the birth of her last child, when she had a discharge from both ears; this ceased, and left her very deaf. Her ears presented much the same appearance as in the last case, the principal feature being the dry condition of the meatus. Glycerine was applied with the forceps and wool, and the woman was soon relieved from the unfortunate impediment.

Louisa R——, Hampstead, August, 1850, aged twenty-seven, deaf nine years. Ten years since, had measles, followed by a discharge, which lasted four months; it then ceased in both ears, and she has been deaf ever since that period. Hears better after washing her ears. The only peculiarity to be observed was a total want of wax. The glycerine was applied in the usual way, and gave almost instant relief. In six weeks her hearing was quite restored. This was a very remarkable case.

In other cases, where the ears are plugged with hardened, impacted wax, and where the membrana tympani is only coated with vitiated wax, the glycerine must be dropped into the ear three or four times during the day. In twenty-four hours, the hardened mass will generally become sufficiently softened for removal—a little operation which requires some caution in its performance. If force be used, a portion of the delicate membrane of the drum may be torn away, and unpleasant consequences ensue. The mass will generally separate without force of any kind, if the means recommended be carefully followed; gentle syringing will also promote the separation. A pellet of fine sheep's wool, moistened with glycerine, should be placed in the meatus, in order that the newly-exposed surface may be brought under the direct operation of the remedial agent. The pellet also would be of use in protecting the parts from the effects of cold and the sudden influence of the air. The removal of an impacted mass of exsiccated cerumen without these precautions may produce more deafness than the presence of the offending substance.

Master P——, City-road, aged six years, deaf in the right ear six months. Has had a constant roaring noise in that ear, which was frequently swollen, and very sore; he had been ordered purges and lotions, from which no benefit resulted. On examination, the meatus was found completely blocked up with hardened wax. I filled the ear with glycerine, and then fitted the plug. The next morning I easily removed the obstruction, and in it was found a good sized cherrystone. The hearing was painfully acute for a few days. Sheep's-wool was kept in the ear. I mention this case to show how necessary it is thoroughly to investigate every case which presents itself to you. I remember another instance occurring in a member of parliament, who was annoyed at intervals for two years by a discharge from, and painful swelling of, the right ear. At last the dens sapientiæ of that side became painful, and the gum inflamed; this tooth was removed, and the ear was soon well. This case I consider very instructive; and the close proximity and anatomical relations of the part justify the supposition, that the diseased condition of the tooth caused the deafness and discharge from the ear.

H. R——, aged forty-three; Sept. 1850; an out-patient of this hospital; very deaf in the right ear; could not hear No. 3 of the sonometer; cannot refer it to any cause; it appeared very gradually. He suffers from a "blowing sound" in that ear; when masticating his food, each fall of his jaw sounds like the report of a pistol; at other times he hears loud crackling noises. As I suspected in this case, an impacted mass of solidified wax was found, filling up the inner third of the meatus. Glycerine was poured in until the meatus was full; the bees-wax plug was then applied. In two days the wax was completely softened, and could be easily removed. The hearing was perfectly restored.

Another mode of applying the glycerine consists in soaking a pellet of sheep's wool in the fluid, and pushing it gently into the meatus until it rests against the drum. The wool, when compressed, should be about the size and shape of the aural cul-de-sac. A plug of prepared bees-wax, warmed in hot water, and placed against the external opening, and retained there, will effectually prevent both the entrance of the atmospheric air and the exit of the glycerine.

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This proceeding must be repeated every morning, the meatus being each time carefully cleansed by means of warm water, and made dry by passing backwards and forwards a small piece of dry cotton; then there will be a clear surface for the action of the glycerine.

One of the judges of the superior courts consulted me, with the concurrence of Sir B. Brodie. The learned judge was suffering from deafness in the right ear. The organ had become quite useless. The left ear was also partially deaf, but with the assistance of a very clever instrument, made by Mr. Rein, Strand, he was enabled to continue his judicial duties. On examination with the speculum auris, assisted by a powerful reflector, I found the lining membrane of the meatus dry and polished, the canal open and very straight, and the membrane of the drum of a pearly whiteness, the central part projecting into the meatus, and presenting even more opacity than the other parts; no ceruminous secretion whatever. The air could be heard to strike against the tympanum in both ears; this membrane was intact on both sides. I applied the wool, well saturated with the glycerine, to the membrane, fitting the bees-wax plug, which effectually prevents the entrance of atmospheric air or the exit of the glycerine, thus keeping the agent constantly against the part to be acted on. This proceeding was repeated every morning, the meatus being gently cleansed with warm water before fresh glycerine was introduced. At different intervals, four distinct layers of white, pulpy epithelium were removed; the ear was occasionally swollen and painful. The treatment was persevered in for more than two months, and the membrane of the drum was much altered in appearance, assuming more of the dark look of the healthy organ. I introduce this case, not as a successful one in its results, but as illustrating very beautifully the mechanical action of the agent in the worst case of epithelial thickening which I have ever seen In this case, had the deafness been due to the mechanical obstruction, it would have proved beneficial, but the cause was purely nervous, as had been previously diagnosed by Sir B. Brodie. There can be little doubt, that in many cases this cuticular deposition is the cause of deficient hearing, but it may be that the paralysis is the exciting cause to this morbid action.

M. O——, Clerkenwell, aged fifty-three, August, 1850. Deafness in both ears; followed a severe attack of influenza; never had any discharge from either ear; occasional pain in both ears; when travelling in a railway carriage hears better than other persons. On examination, the aural culde-sac was found to be dry and inelastic, and to have the appearance of parchment; the membrana tympani looked white, and of a cartilaginous consistence; no wax or moisture of any kind; the meatus and tympanum painful to the touch. The glycerine was used as in the last case. From the right ear two pieces of epithelium, of a pulpy consistence, were removed, and one thick piece from the left ear. In seven weeks she discontinued her attendance, hearing, when at church, the clergyman of the parish, a blessing which (as she had stated) she never again expected to enjoy. I had twice to modify the treatment in this case, as some pain and swelling supervened.

Henry M——, Esq., a merchant, aged sixty-two, consulted me October 16, 1850. Had been deaf for more than twelve years in his right ear; he could not hear the loudest tone of the sonometer. The meatus had quite a "parchment appearance." The ear was filled with glycerine, and the bees-wax plug introduced. This was repeated every day. In fourteen days several pieces of soft skin-like substance were removed, with evident improvement to the patient, who could now hear No. 3 of the sonometer. I was obliged to modify the treatment once, as the patient complained of pain. In this treatment the general health, especially the secretions, should always be watched.

Mary M——; Sept. 15, 1850; Brentford; aged twenty-six; deaf in both ears; could not hear the highest tone of the sonometer; meatus dry and inelastic; tympanum much thickened; not perforated; not painful to the touch. Treated as in preceding case; treatment lasted six weeks. Two portions of cuticular soft substance came away from the right ear; the left did not appear much affected by the glycerine. In six weeks the patient heard No. 3 of the sonometer, at a distance of two feet from the ear. No improvement whatever in the right ear. I saw this patient a few days since; she states that the relieved ear fully answers all the purposes required.

When patients are treated in this way, they, of course, require the constant attention of the surgeon. The *modus operandi* is simple enough; the glycerine being kept continually in contact with the part, acts mechanically, either absorbing or penetrating the epithelial coating and separating the individual particles. The ordinary time required for this treatment varies from two to eight weeks, according to the method employed. With respect to the permanence

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of the relief—some cases always require the presence of glycerine, as the best known substitute for the natural secretion of the aural membrane. The frequent introduction of glycerine tends to restore the external meatus to a healthy condition, and fit it for the proper transmission of sound.

I mention the following case as one amongst several which I have seen, proving that glycerine, if it be not quite pure, and made according to the proper formula, may cause irritation, and produce other unpleasant symptoms; and there is little doubt that from such cause this really valuable remedial agent has frequently suffered in repute.

A lady, living at the West-end, aged sixty-eight, consulted me two years since for deafness in both ears. They presented the appearance which indicated the use of glycerine. During eighteen months she lubricated her ears with this agent, receiving considerable assistance and comfort from it, and entirely laying aside the acoustic instrument which had been previously ordered. One morning I was hastily summoned to this lady; she was in considerable pain; the right ear greatly swollen and inflamed; she was much alarmed. She stated that she had used the glycerine regularly. The cause of the pain and swelling I soon discovered to be the stale and impure glycerine, which appeared quite changed in character, having an offensive smell, and being too light in color, of thin consistence, and deficient specific gravity. This *contretemps* was treated in the usual way, and she again uses pure glycerine with the same advantage as before.

In the removal of foreign bodies from the ear the glycerine is often eminently useful. Some months since a solicitor of Gray's-inn consulted me respecting pain and deafness in the right ear; he had suffered much pain for five months. The annoyance had so affected his general health that he was quite incapacitated from following his professional pursuits. There was an occasional discharge from the ear. The meatus and external parts were swollen, sore, and emitted a light muco-purulent fluid. There was a mass of offensive-looking wax. On being touched with a probe it was found hard and resisting. The glycerine was dropped into the ear in the manner just described. On the next day the impacted mass was easily removed. When examined, in the midst of it there was found a common *fly*, a foreign body which had evidently been the cause of the mischief. The use of the glycerine was continued for a few days, the pain ceased, and the hearing was soon restored.

This instrument,* called a *sonometer*, has proved of the greatest value in practice—not from any use it possesses as a curative agent, but that it proves, beyond a doubt, the effects of treatment, both to practitioner and patient. This must always be satisfactory. Thus you can test the progress of a case at stated intervals. It has done service to the profession.

It will be seen that sheep's wool is invariably used, instead of cotton wool. Its advantages are many: its elasticity enables it always to retain the position in which it is first placed; and for the same reason it is more easily withdrawn from the meatus. Cotton wool, when dry, changes its position, and in many cases is with great difficulty removed.

The mode of preparing the wool is very simple. The finest curled wool on the sheep's *head* is carefully cut with scissors, and washed in hot water: when dry, it is ready for use. The best wool is that procured from a small German sheep. This, however, is not always to be procured, and the other answers every purpose well enough.

In the paper already alluded to at the commencement of this lecture, I published several reports of cases—and amongst them will be found that of a girl, an hospital patient, now living at Chad's-place, Gray's-inn, and that of a lady living in Adelaide-terrace, Islington,—the former had been deaf eighteen years, arising from scarlet-fever; she was completely cured, and has not to this day any return of the distressing impediment. The other case is that of a lady, deaf thirty years, in whom the glycerine still acts as an artificial aid, and enables her to take part in conversation. Her son was with me but a few days since, and he tells me that relief is always afforded by the application of the glycerine. These cases I have been enabled to watch for nearly two years, and it is satisfactory to know that the good effects in them have been permanent.

Glycerine is particularly useful in deafness following eruptive or other fevers; also in deafness arising from thickening of the drum, caused by an epithelial deposit. In the last-noticed condition, glycerine separates the epithelial excrescence, and thus restores the membrane to its natural state and appearance. Sir Astley Cooper, who at an early period of his brilliant professional career devoted much attention to diseases of the ear, used *nitrate of silver* for effecting a separation of the cellular formations in these cases. But the glycerine, perfectly

* For description and engravings, see *The Lancet* for July 28, 1849.

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innocuous, is a more effectual, and at the same time a safe, remedy. When the drum is perforated, the glycerine must be only applied to the walls of the meatus, care being taken not to use a sufficient quantity to admit of its being introduced or forced into the tympanic cavity. Should such an accident occur, tepid water ought to be immediately syringed into the ear, and the operation repeated three or four times. In this way the glycerine would be quickly removed.

In only one instance have I seen the glycerine produce pain or annoyance on its first application. A gentleman whom I saw in consultation with Mr. Guthrie suffered most acutely from the introduction of the remedy into his ear. A repetition of the operation was attended with a similar result. This is the only instance of the kind that I have witnessed. There was in that case a thickened tympanum, and an absence of cerumen. Apparently there was neither excoriation nor inflammation. The second application of the glycerine was made two days after the first. The effect precisely corresponded with the result in the first instance. It is almost needless to observe, that there was no repetition of the operation. The patient was highly nervous and excitable. Still I must confess that the cause of the pain felt by that gentleman remains entirely unexplained. In not another instance have I known any untoward event result from the introduction of glycerine into the human ear.

In old age there is usually a deficiency of cerumen, and the action of the glycerine is then very marked. It affords much comfort by allaying "irritation," which is the invariable distresssing accompaniment of a dry meatus. The tinnitus in the ears is also frequently relieved by the soothing effects of glycerine, where that noise is occasioned by a dry meatus. At the same time, it must be remembered that many distressing cases are due to abnormal conditions of the brain, nerves, heart, or bloodvessels.

The object of delivering this lecture is simply to confirm the reputation of *Glycerine*, and enlarge the boundary of its usefulness. For the relief and removal of some forms of deafness, *Glycerine* stands alone as a remedial agent. With a due perseverance in its employment by careful practitioners, it will often be the means of removing a distressing affliction.

It has been stated by some writers that glycerine is an *oily* fluid, and therefore that it is open to the objections that have been urged against oils. But you well know that it is not an oil, and cannot be classed with oleaginous substances. Let me remind you of its chemical properties, and of the method adopted for obtaining it. It is found in fatty oils combined with oleic, stearic, and margaric acids; its specific gravity is 1·252. Glycerine is a syrupy liquid, miscible both with alcohol and water, insoluble in ether, slightly inflammable, inodorous, and of a sweet taste.

The most convenient mode of preparing it is by the saponification of olive oil, by means of litharge and a little water. Sulphuric acid will separate the oily matters, leaving an aqueous solution containing the alkaline salt along with the glycerine. The mixture is evaporated to dryness, and treated with alcohol, which again dissolves the glycerine, and leaves the alkaline sulphate undissolved. The glycerine may be purified from oxide of lead, by passing through it a current of sulphuretted hydrogen.

EMPLOYMENT OF ARSENIC IN DISEASES OF THE SKIN AND INTERMITTENT FEVERS.*

BY M. GIBERT.

M. GIBERT, surgeon to the Hospital of Saint-Louis, has published a long article in the *Bulletin Général de Thérapeutique*, on the action of arsenical preparations in the different diseases for which it is recommended, and he comes to the following conclusions.

A. The arsenical preparations employed by the ancients, resumed by the practitioners of the eighteenth and nineteenth centuries, can be considered as innocent only in the following conditions.

1st. Using either the preparation or doses in rigorously fixed quantities, using in preference the liquid form, and whether it be the arsenical salts of soda or potassa, or arsenious acid, it must always be diluted in a large quantity of water; the daily dose for adults may then amount to 1 centigramme, and sometimes in exceptional cases it may be raised to 2, 3, and even to 5 centigrammes.

2nd Carefully watching the effects of the medicine, suspending it on the least indication of gastric or intestinal irritation; generally avoiding its use for children, and for irritable, weak, or consumptive persons.

B. This medicine, reserved for obstinate rebellious diseases which resist all other methods of treatment, frequently succeeds in periodical fevers, nervous complaints,

* *Journal de Pharmacie et de Chimie*, January, 1851.

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neuralgia, cutaneous diseases, certain chronic affections of the circulation and pulmonary organs. Success has been attributed to it in some strumous, cancerous and syphilitical affections

C. For external application, the above-mentioned solution may be employed in a more concentrated form, or else the caustic powders of Rousselot, Father Cosmo, Anthony Dubois, or Dupuytren. But it is generally prudent to abstain from all kinds of applications on fresh sores, above all on the face or in the vicinity of the buccales glandulæ.

The arsenical preparations so much extolled in cancerous affections have no specific virtue; but have an energy and a certainty of caustic action which causes them to be preferred to others.

M. Gibert prefers M. Felix Boudet's formula for depilatory pomade to those which contain orpiment.—*Bulletin General.*

As a conclusion to the work of M. Gibert, we are going to place before our readers a summary of the remarks upon arsenic made by M. Bernier of Sarguemines, Dr. Vaulpré of Bourg, and Dr. Fuster of Montpellier.

In a memoir presented to the Academy of Medicine in the month of October last, M. Bernier, surgeon to the hospital of Sarguemines, shows the satisfactory results which he has obtained from the use of arsenious acid in intermittent fevers; in the majority of cases he has had to do with the obstinate fevers contracted in Africa, and complicated with engorgement of the spleen and other viscera, infiltration, &c.; the fever has generally yielded after the arsenic has been taken once or twice, and the spleen has rapidly diminished in size.

The *Bulletin de Thérapeutique* of September contains a letter by Dr. Voulpré of Bourg on the use of arsenious acid in intermittent fevers: Dr. Vaulpré practises in the Dombes, where agues are so frequent; he has administered this medicine in three hundred and ten cases, namely:—

In quotidian fevers	102
Tertian fevers	157
Quartan fevers	51

The medicine has always been administered as soon as the periodical attacks have been defined and well regulated. The dose has been 1 centigramme in 100 grammes of distilled water.

Out of the three hundred and ten cases of fever, one hundred and ninety-seven have been stopped by the first, second or third dose; twenty-nine have been cured by the fourth or fifth. When five doses have failed, a sixth has not been given. In eighty-four cases, after having administered arsenic five times without success, recourse was had to the sulphate of quinine or cinchona.

Here are the conclusions at which Dr. Vaulpré arrives:—

1st. The quotidian and tertian fevers are those that are most quickly cured by the use of arsenic.

2nd. The quartan resists this means the most often.

3rd. In fevers in which there have been several relapses, arsenic has been very efficacious.

4th. Arsenic is not so efficacious in engorgement of the spleen as sulphate of quinine.

Dr. Vaulpré adds that the administration of arsenious acid to adults is perfectly free from danger, if given with prudence; but he advises its omission from medicine for children. He advises, moreover, that it be prescribed under the name of mineral febrifuge liquor, on account of the *horror* with which the public are inspired on the mention of the word arsenic.

Dr. Vaulpré has not said whether relapses are more or less frequent in fevers treated by arsenious acid; it is, however, an important element of the question. Is the cure as durable, when obtained by arsenious acid, as when effected by sulphate of quinine?

On the 19th of November, the Academy of Medicine received a note from Dr. Fuster, Professor of Clinical Medicine at Montpellier, concerning the use of arsenious acid in intermittent fevers, of which the following are the conclusions:—

Inveterate agues which rebel even against treatment with quinine, yield to the employment of arsenic.

Those that resist this remedy may be cured with sulphate of quinine.

According to Dr. Fuster, 5 centigrammes of arsenious acid should at first be administered, during twenty-four hours, in 3 or 4 doses, and at last even 9 or 10 centigrammes may be given in twenty-four hours, without having any fear of accident. The best formula consists in mixing the medicament with sugar of milk, in the proportion of a twentieth part.

When the periodical attacks cease, diminish the doses in the same proportion that they were augmented, and conclude with the same as the first dose.

Emetics administered in the beginning and in the course of the treatment, maintains or re-establishes the toleration of this acid. It is not necessary to observe any particular care in the diet, except on the day on which the emetics are taken. With

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this precaution, this medicament is always easily tolerated by the patient.

Engorgements of the viscera are not cured so quickly as fever: they diminish and disappear only by the persistence of the normal state.

It will be seen that the conclusions of Dr. Fuster are nearly the same as those of M. Bernier of Sarguemines, and of Dr. Vaulpre of Bourg; only the doses used by the professor of Montpellier are rather larger, but he has never had any accident to regret. This, then, ought to induce practitioners to try this medicine especially in poor countries, where endemical agues reign, and where the people suffer from fevers during entire years, from inability to buy the sulphate of quinine, the price of which increases each day. But we must also allude to the fact mentioned by Dr. Vaulpré: the horror the public have of arsenious acid. It is sufficient, he says, to mention the word arsenic to raise a cry of poison; and he himself, notwithstanding the good results obtained, was obliged to cease the administration of arsenious acid when the people found what he prescribed, and he therefore advises it to be prescribed under the name of mineral febrifuge.

POISONING BY LAUDANUM.*

Dr. A. prescribed for a patient 8 grammes of Sydenham's laudanum, desiring 10 or 12 drops to be put into each lavement. The prescription was taken to the Pharmacien, who sent a phial containing laudanum on which he took care to put a label stating the manner in which it was to be employed. The husband of the patient, by mistake, instead of the number of drops prescribed, put the whole contents of the phial into the lavement. Soon after, the patient experienced symptoms which alarmed those who were with her: the pharmacien was sent for, and, before the arrival of the physician, administered a very powerful purgative lavement, and, as a drink, infusion of raw coffee (in the absence of coffee, nutgalls or tannin may be employed with advantage).

These means succeeded completely, and when the physician arrived, the patient, although still under the influence of opium, was quite out of danger. There afterwards remained no trace of this poisoning, and the person enjoyed good health.

* *Journal de Chimie Médicale*, Fevrier, 1831.

FORMULA FOR PILLS OF IODIDE OF IRON.*

BY M. BLANCHARD.

The following proportions are for one hundred pills: Iodine, one drachm; iron filings, half a drachm; distilled water, two drachms; honey, four scruples; any absorbent powder, two drachms and a half. The water, the iodine, and the filings are to be introduced into a small glass flask; as soon as chemical action commences, the mixture is to be shaken briskly, and the resulting green fluid filtered into a little iron capsule, the weight of which has been previously ascertained. The flask and the filter are to be washed with two additional drachms of distilled water, mixed with a very small portion of the honey. Mix the liquors, add the remainder of the honey, and evaporate at first rapidly, and subsequently at a lower temperature, until the weight of the mixture be exactly equal to that of the iodide and the honey; that is, to about eight scruples. Add a sufficient quantity of powdered marshmallow root, (or, what is better, of a mixture of equal parts of it and of powdered liquorice), about two drachms. Divide the mass into four equal parts, which are to be rubbed in powdered iron. Roll the little masses into cylinders, on an iron pill machine, and divide each into twenty-five pills, which are to be rolled in a fresh quantity of powdered iron, in order to cover any portions of iodide which may have been deprived of their coating by the machine. Expose the pills to a moderately warm temperature, so that they may not attract moisture from the atmosphere, and proceed without delay to the second part of the process, which consists in covering them with a varnish, as follows:

Dissolve one part of balsam of Tolu in three of pure ether; pour some of this tincture into a little porcelain capsule containing the 100 pills, and rotate the capsule rapidly, so as to moisten the entire surface of the pills and promote the evaporation of the ether. Lastly, as soon as the pills begin to adhere, throw them on trays coated with mercury, taking care to separate such as may have united. Leave them for twenty-four hours in the open air, and finally dry them in a stove, at a temperature of from 68° to 77° F.

It will be found useful to give them a second coat of varnish. Each pill is composed, with other matters, of rather more

* *Journal de Pharmacie et de Chimie*, October, 1850.

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than three-fourths of a grain of iodide of iron, and about one-seventh of a grain of pulverised iron adhering to the surface; the entire being covered with a layer of balsam of Tolu, weighing scarcely 0·046 grain, if single, or about twice as much if double.

ON A METHOD OF ASCERTAINING THE PURITY OF THE SIMPLE MERCURIAL OINTMENT.*

BY M. E. BARRUEL.

No one applauds more than myself the severity sometimes showed by the members of the jury charged with visiting the pharmaceutical establishments; this strictness is opposed without doubt to more or less defective preparation of the ordinary medicaments.

But that the examining jury may retain its power in the eyes of well-instructed men, it is necessary that the means of analysing or investigating employed by it should have a real value, and not expose it to commit errors which might throw a stain upon the reputation of conscientious pharmaceutists.

This year the jury came to me and asked to see some simple mercurial ointment. To my great surprise, these gentlemen declared that my ointment was badly prepared, giving as a reason for this complaint, that the ointment floated on water instead of sinking in it.

When I saw that, notwithstanding my assurances and my reputation as a chemist, the members of the jury persisted in their opinion; I demanded that a sample of my simple mercurial ointment should be taken to the school of chemistry to be examined.

I prepare my double merculiar ointment by the process of M. Chevalier. This process which I have used for twelve years, enables me to prepare several kilogrammes in less than an hour.

This process consists, as is known, in melting half of the lard, introducing it in a stone bottle with all the mercury (the bottle ought not to be more than half full), corking the bottle well, and communicating to it a rapid and jerking motion. This movement ought to be continual, two persons are therefore required to perform the operation without too much fatigue, until the noise produced in the bottle becomes dull, and the matter poured on a card has the consistence of melted honey. Then empty the contents of the bottle into a large marble mortar, containing a small quantity of old mercurial ointment, and the remainder of the lard, beat it up quickly with the pestle; in an hour the ointment is ready, but the grease is beaten in such a manner that the pomade becomes greyish; it becomes in time a greyish black. It is with this ointment according to the prescription in the *Codex*, that simple mercurial ointment ought to be prepared, which should contain one-eighth part of mercury.

This preparation is made in a glazed earthen pan or marble mortar, beaten thoroughly with the pestle in order to produce a perfectly homogeneous pomade.

It is evident that by the beating a large quantity of air is introduced, which doubtless, alters the specific gravity of the pomade; and such is the reason I give for the floating of my simple mercurial ointment.

I asked one of the members of the jury to produce at once some simple mercurial ointment, with my simple mercurial ointment, which had been recognised to be of good quality; the ointment thus prepared, to the great surprise of the jury, floated on water. Two months after I went to the School of Pharmacy where the chemical examination of my mercurial ointment took place, an examination which proved that it had been properly prepared, seeing that in 16 grammes of pomade 2 grammes of mercury were found.

The trial in water was again made, and this ointment, *which had floated* two months before, now fell rapidly to the bottom of the water; it was the same with that prepared by the jury at my house.

I think we ought not to attach any importance to so inaccurate a characteristic which can be modified by the manner in which the ointment has been prepared and the date of its preparation.

As for the process I saw followed for the analysis of the ointment prepared by me, which consists in treating it several times with hydrated ether, I prefer, for the economy of matter and of time, rectified essence of turpentine, aided by the action of heat.

The operation is performed in a matrass flat at the bottom and with a large aperture; the essence is used three times; nearly four times the weight of the ointment is necessary, heat it in a sand bath, and conclude the washing with a little alcohol at 36°. Dry the matrass in the sand bath, inserting in the top a funnel of blotting paper. The difference in the weight of the matrass before operation, and the weight of the matrass containing the metal gives the weight of the latter. The experiments requires from 15 to 20 minutes.

* *Repertoire de Pharmacie.*

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ON THE ACTION OF THE GOLDEN SULPHURET OF ANTIMONY.*

BY DR. BOECKER.

THE investigations contained in this essay of Dr. Boecker's have been conducted with the greatest care, the author having experimented on himself with the medicine and having carefully examined the principal exertions before, during, and after its use. The examination of the urine, especially furnished some interesting results. During the use of the golden sulphuret, the bowels acted regularly, once a day; but when the author omitted to take the medicine, he remained several days without a motion. Whenever the alvine evacuations were increased, the quantity of urine was diminished, particularly in its solid contents, as appears from numerous analyses which are recorded. An interesting circumstance is, that the quantity of urine and of solid excreted matters increased with the dose of the medicine, and *vice versa*. It is also worthy of observation, that the fixed salts in general, as well as the salts insoluble in water, were increased by its exhibition. On the whole, it would appear from the experiments that, during its use, a more rapid renovation takes place in all the organs and all the tissues. Another circumstance to be observed is, the increase in the quantity of sulphuric acid in the urine, which was nearly double the ordinary amount, doubtless in consequence of the sulphur in the preparation being converted into the acid, which subsequently enters into the formation of the urinary sulphates. The author also details the results obtained from the examination of the pulmonary exhalation. During the use of the golden sulphuret, the amount of carbonic acid was increased, while it gradually diminished on discontinuing the medicine. The quantity of watery vapor, on the contrary, underwent no change. As to its action on the blood, the author found that it diminishes the amount of the solid constituents of that fluid. Blood drawn from a vein was at first black, but gradually became red when exposed to the air, and this change took place more rapidly than when the sulphuret was not exhibited. The microscopic examination of the blood showed that the nucleated globules visible in normal blood disappear.

To recapitulate: golden sulphuret of antimony increases the secretion of urine and the exhalation of carbonic acid; it stimulates the intestinal and cutaneous excretions, as well as the secretions of the mucous membrane; and it thus hastens the metamorphosis of the system, an effect which is even to be detected in the blood itself.

* *Archiv. für Physiologische Heilkunde.*

IV. REVIEWS, NOTICES OF BOOKS, &c.

MEDICINES: THEIR USES AND MODES OF ADMININISTRATION; Including a Complete Conspectus of the Three British Pharmacopœias, an Account of all the New Remedies, and an Appendix of Formulæ. By J. MOORE NELIGAN, M.D. Edin., M.R.I A., Lecturer on the Practice of Medicine in the Dublin School of Medicine, &c., &c. London: Longman & Co. Dublin: Fannin & Co. 1851. Pp. 555.

The talented author of the work before us is a practitioner of considerable eminence in Dublin—favorably known to the medical profession as the writer of "A Treatise on Eruptive Diseases of the Scalp," as editor of Dr. Graves' "Clinical Lectures on the Practice of Medicine," and is now the editor of the "Dublin Quarterly Journal of Medical Science."

Of a work which has for some years enjoyed the confidence of the profession, and which has now reached a third edition, it is scarcely necessary to say much. The size of the work has been considerably increased, and its practical value greatly enhanced, chiefly by additions in the account of the therapeutical effects of individual medicines, and the introductory remarks in each chapter have been somewhat, and most judiciously, enlarged.

A most useful table of weights and measures, according to the several British, Irish, and French systems, has been added to this edition, for which the author owns his obligation to his friend, Dr. William K. Sullivan, Chemist to the Museum of Irish Industry (successor to Sir Robert Kane).

We have selected the following article from this able work, as a specimen of the author's mode of treating his subjects.

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"NARCOTICS.

"(Anodynes; Hypnotics; Soporifics.)

"Narcotics may be defined, medicines which produce a primary stimulating effect on the nervous and vascular systems, rapidly followed by a depression of the vital powers and sleep, or if a large quantity of the substance be swallowed, by coma. The primary stage, that of excitement, varies much both as to the degree in which it is produced and as to its duration; depending chiefly on the manner in which the narcotic is administered, on idiosyncracy, and on habit. In large doses, the stage of excitement is so short, and the depression of vital power so immediate, that it has led many to deny altogether the stimulant property of narcotics, and to regard them as producing direct sedative effects on the system. An attentive consideration, however, of the *modus operandi* of the medicinal agents described in this chapter and a comparison of them with those which are contained in the chapter on Sedatives, must, I think, satisfactorily prove that their operation is perfectly different. Indeed, some narcotics, as opium, are frequently administered with the intention of producing a stimulant action only. When given with this intention, the doses should be small, but frequently repeated, in order to sustain the state of excitement; but when administered with the view of producing sleep, the doses should be larger, and repeated at more distant intervals. All these points, however, will be more fully explained in the description of the therapeutical effects of the individual remedies of the class. Idiosyncracy has a remarkable influence on the effects of narcotics; we meet with some individuals almost insensible to their action: while in others, small doses produce a dangerous stupifying effect, or in some instances give rise to a degree of excitement, amounting to furious delirium. But habit influences the action of narcotics on the system more than any other circumstance, their power being diminished in an extraordinary degree by repetition; where therefore their continued administration is required, it will be necessary to augment the dose gradually, in order that their usual effects may be produced. The influence of age on their action must also be borne in mind in their administration; the young being much more susceptible to their influence than individuals of mature age. The close connection that exists between narcotics and stimulants is well exemplified in the effects of alcoholic stimulants on the system; to these which are so well known I need not further refer here than to point out the distinction that exists in their mode of operation: stimulants produce narcotism simply by their *exhausting* action on the nervous system, and to cause it they must be given in an overdose; while narcotics have a direct and specific effect on the functions of the cerebro-spinal system of nerves, allaying pain and irritation even before narcotism is produced. We thus see that this class of medicinal agents closely resembles and partakes of the characters of both sedatives and stimulants; and no other proves so distinctly the difficulty of forming a therapeutical classification of the Materia Medica based on true scientific principles: in fact not here alone, but in medicine generally, science is often well sacrificed to utility.

"BELLADONNA, D. L. E. *Leaves (and root, D.) of Atropa belladonna. Deadly nightshade.* An indigenous plant; belonging to the Natural family *Solanaceæ*, and to the Linnæan class and order *Pentrandia Monogynia.*

"BOTANICAL CHARACTERS.

"Root, fleshy, creeping; Stems 3-4 feet high, herbaceous; Leaves, ovate, acute, entire, smooth, some very large, but placed in pairs of unequal sizes; Flowers, auxillary, on short peduncles, drooping, lurid purple, about an inch long; Berries, shining, black, about the size of a black cherry, filled with a sweetish pulp in which are imbedded many kidney-shaped seeds.

"PREPARATION.

"The root, which is contained only in the *Dublin Pharmacopœia*, is scarcely ever used at present; it should be dug up in the month of March, and dried quickly. The leaves are gathered in June and July before the flowers expand, and dried with a stove heat.

"PHYSICAL PROPERTIES.

"Belladonna root is from one to two inches in diameter, and a foot or more in length; it is of a grayish-white color internally, grayish-yellow externally; it has a faint nauseous odor, and a slightly astringent bitter taste. The leaves when fresh are of a sombre-green color, which becomes yellowish-green in drying; they have a feeble odor, and a herbaceous, somewhat nauseous taste.

"CHEMICAL PROPERTIES.

"The medicinal properties of belladonna depend on a peculiar principle which has been named *atropia*; it was first discovered by M. Brandes in the leaves, in which he found it to exist in combination with malic acid, two nitrogenous extractive matters called by him *pseudotoxin* and *phytocolla*, gum, wax, chlorophylle, starch, albumen, lignin, salts, &c. *Atropia* when obtained

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quite pure is in white transparent prismatic crystals of a silky lustre. It is without odor, but possesses a nauseously bitter, acrid taste; it requires for its solution 500 parts of cold water, the solution having a bitter taste and an alkaline reaction, but is very soluble in alcohol and ether; it combines with acids to form salts. The composition of atropia, according to Liebig, is $C^{34}H^{23}O^6N$. Belladonna leaves and root yield their active principles to both water and alcohol.

"*Adulterations.*—The leaves of the *Solanum nigrum* are sometimes sold for those of the Atropa belladonna; the former are smaller, obtuse angled, not acuminated, and they are bluntly toothed; by which characters they may be readily distinguished.

"THERAPEUTICAL EFFECTS.

"Belladonna acts on the system as a powerful narcotic, in large doses proving an active poison, causing constriction of the throat with ineffectual efforts to vomit, delirium usually of a gay or mirthful character, with excessive dilatation of the pupils, then coma which is followed by death unless active treatment be immediately employed. In medicinal doses it operates as an anodyne and calmative, diminishing pain and over excitement of the nervous system; with this intention, it has been employed in most neuralgic and convulsive diseases, but it is not so much used at present in these affections as it formerly was. It has been generally stated that belladonna should not be employed in acute inflammations or febrile affections, but more recent observations have shown that a state of inflammation in the system does not contraindicate its use. The diseases in the treatment of which belladonna is found most beneficial are the varieties of neuralgia, and spasmodic and painful affections; thus it has been found most useful in tic doloreux, in all forms of external neuralgic pains, in nervous palpitations, in hysteria, in epilepsy, in hooping cough, in spasmodic stricture of the urethra, in painful spasm of the *sphincter ani* when there is no fissure of the part, in dysmenorrhœa, in orchitis, after the acute stage has subsided, in painful glandular enlargements, in chronic athritis, in the flying pains of rheumatism and in incontinence of urine in children. In all these cases, the external employment of the drug is advantageously combined with its internal administration. Belladonna has been used as a prophylactic of scarlatina when that disease rages as an epidemic, and several instances of its apparent success as such were, I believe, first narrated in Germany; later experience has fully confirmed its powers in preventing the spread of this affection, when it breaks out in schools or where many young persons are congregated together; amongst the most recent investigations on this subject may be cited, those of M. Lecointe of Paris, in which 2227 children and adults had been preserved from scarlatina by its use; those at Lauenrodorf, in Prussia, where in the Orphan Hospital, out of 160 inmates to whom the drug was administered immediately on the breaking out of an epidemic, but two contracted the disease; and those of Dr. Newbigging in Watson's Institution in Edinburgh, where out of 69 children exposed to the contagion but 3 took the disease. Belladonna applied externally in the neighborhood of the eye, causes, after the lapse of a few hours, dilatation of the pupil unattended with any disturbance of vision; to produce this effect it is employed in the operation for cataract, in iritis to prevent adhesions from forming, and in other opthalmic affections to enable the posterior chamber of the eye to be examined with greater facility.

The alkaloid atropia has for some years back been used on the continent, particularly in Germany, and more lately in this country, in the treatment of disease of the eye; Mr. Wilde was the first physician in this country to publish his experience of its effects. He has found a single drop of solution of atropia, No. 1 (*see below*), dropped on the lower lid, to dilate the pupil to double its ordinary size, or rather more, in from 5 to 15 minutes after its application; the dilatation lasting for four or five days. Mr. Wilde uses the solution of atropia in the same cases as he would extract of belladonna, over which it possesses the advantages:—of being much more efficacious, and much more cleanly, and of producing neither pain nor irritation when dropped into the eye; it is also free from the objection to which extract of belladonna is liable, that of producing an unpleasant eruption around the eye-brow on which it has been applied.

"DOSE AND MODE OF ADMINISTRATION.

"Dose of the powdered leaves, gr. j., which should be increased very gradually until dryness of the throat is produced. As a prophylactic of scarlatina it is given twice a day, in doses of from $\frac{1}{4}$th to $\frac{1}{3}$rd of a grain, according to the age of the child.—*Extractum Belladonæ*, D. L. E. ('Take of fresh belladonna leaves, collected when the plant begins to flower, any convenient quantity. Crush them in a mortar, express the juice, and allow it to stand for twenty-four hours. Pour off the clear liquor, and set it aside for subsequent use; and having placed the sediment on a calico filter, wash it with an equal bulk of distilled water, and

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mix the washings with the decanted liquor. When, by the application of a water heat, coagulation has occurred, skim off the coagulated matter, filter the hot liquid through flannel, mix in now the washed sediment, and evaporate to the consistence of a firm extract, by a steam or water bath, constantly stirring, particularly towards the close of the evaporation,' D.—'Fresh belladonna leaves, ℔j; bruise them, sprinkled with a little water, in a stone mortar; then press out the juice, and evaporate it unstrained to a proper consistence,' L.—'Fresh belladonna, any quantity; bruise it in a marble mortar into a uniform pulp, express the juice; moisten the residuum with water and express again. Unite the expressed liquids, filter them, and evaporate the filtered liquids in the vapor bath to the consistence of a firm extract, stirring occasionally towards the close,' E.) Dose, gr. ss., gradually increased to gr. iij. or gr. iv. This is the preparation generally employed to dilate the pupil, for which purpose it is applied round the eye; in spasm of the urethra preventing the introduction of an instrument, the catheter has been smeared with extract of belladonna, but the benefit derived from its use is doubtful. It has been also applied to the os uteri in protracted labor caused by rigidity.—*Emplastrum Belladonnæ*, D. L. E. ('Take of extract of belladonna one ounce; resin plaster, two ounces: melt the plaster by the heat of a steam or water bath, then add the extract, and mix them intimately,' D.—'Resin plaster, ℥iij.; extract of belladonna, ℥iss.; add the extract to the plaster, melted by the heat of a vapor bath (with a gentle heat, E.), and mix them,' L. E.) An excellent local application over the sacrum in dysmennorrhœa, and for the relief of neuralgic and other pains.—*Tinctura foliorum Belladonnæ*, D. (Take of belladonna leaves, dried, and in coarse powder, five ounces; proof spirit, two pints; macerate for fourteen days, strain, express, and filter.) Dose, min. iij. to min. viij.; ʒj. added to ʃ℥iv. of water or of any liniment may be used as a lotion.—*Unguentum Belladonnæ*, (Extract of belladonna, 3ij.; axunge, ℥j.; mix.) In painful hemorrhoidal affectio s, in chordee, in orchitis, and in neuralgia.—*Succus Belladonnæ*, (Prepared by expressing the fresh leaves collected in the beginning of July, setting aside the expressed juice for 48 hours, and adding to the clear decanted liquor a fifth part of rectified spirit). Dose, min. xx. to min. xl. gradually increased.—*Solution of Atropia*, Wilde. (Atropia, gr. j.; dilute nitric acid, min. j.; rectified spirit, min. iij.; distilled water, ʒj.; mix.) A solution of this strength is labelled No. 1.; Nos. 2 and 3 contain respectively two and three grains of atropia.

"In poisoning with belladonna, stimulating emetics followed by active cathartics shou'd be employed, with cold applications to the head; and if coma be present, ammonia should be administered, and the usual external stimulants applied."

We also add the following from the Chapter on Special Stimulants.

"AURUM. *Gold.* This metal is not contained in any of the British Pharmacopœias, nor are any of its preparations employed in this country in the practice of medicine. They are, however, frequently administered on the continent, and their virtues highly spoken of in some diseases. Although it has been stated by many that metallic gold is perfectly inert, a powder of gold (*Pulvis auri*) is officinal in the Parisian Codex. It is prepared in several ways: one of the simplest and best is to rub any quantity of leaf-gold with 7 or 8 times its weight of sulphate of potassa in an earthware or glass mortar, as long as any fragments of the leaves are visible; and then to wash well with warm water, which dissolves out the sulphate of potassa, and leaves the gold in the form of a fine powder. Powder of gold is said to be a much more effectual remedy both in primary and secondary syphilis than mercury; it is peculiarly applicable to those cases in which mercury is found to aggravate the disease, or in which the symptoms depend on the excessive use of preparations of that metal; in some instances it produces increased flow of saliva, without affecting the teeth and gums however as that metal does. It has been also used in chronic cutaneous diseases, in scrofulous affections, and in glandular enlargements. Powder of gold may be given internally in doses of gr. ¼ or gr. ½ gradually increased to gr. iij.; it may be made into pill with conserve of roses. It is, however, generally introduced into the system by way of friction on the gums and tongue, or applied on a portion of the skin deprived of the epidermis; it is also used as a local application to chancres in their primary stage. For these purposes, either of the following preparations may be employed.—*Syrup of Gold*, (Powder of gold, gr. xxiv.; simple syrup, ʃ℥j.; mix).—*Ointment of Gold*, (Powder of gold, gr. j.; axunge, gr. xv.)."

"BROMINEUM, L.—*Bromine.* This elementary fluid body was originally introduced into the London Pharmacopœia, merely as being employed in the preparation

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of *Bromide of Potassium*. But within the last few years it has been used in medicine as a substitute for iodine, in consequence of the high price of that substance.

"PREPARATION.

"It is obtained from sea water, and from the waters of many mineral springs, in which it exists in the forms of bromide of magnesium and bromide of sodium, by first saturating with chlorine gas to separate it from the base, adding ether which dissolves out the bromine, and then separating from the ether by means of solution of caustic potassa which combines with the bromine forming bromide of potassium; from this salt it is obtained by a process similar to that for procuring iodine. It has been latterly prepared in large quantities in the United States, having been discovered in many of the brine springs throughout the state of New York.

"PHYSICAL PROPERTIES.

"At ordinary temperatures, bromine is a heavy, dark reddish-brown liquid, of a hyacinth-red color when viewed by transmitted light. Its odor resembles that of chlorine, but is much stronger and more disagreeable. Its taste is very acrid. Specific gravity 2·966.

"CHEMICAL PROPERTIES.

"Bromine is an elementary substance. It is scarcely soluble in water, and its solubility is not sensibly augmented by heat. It is rather more soluble in alcohol and still more so in ether. It is very volatile, boiling at the temperature of 116°. Bromine bleaches vegetable colors like chlorine. It combines with most metals forming bromides with them.

"THERAPEUTICAL EFFECTS.

"As remarked above, it is as a substitute for iodine that bromine is employed in medicine; with which it appears to be nearly if not quite identical in action.

"DOSE AND MODE OF ADMINISTRATION.

"It is seldom used in the uncombined state, but the following solution has been employed by M. Pourche as a substitute for tincture of iodine:—Bromine, one part; distilled water, forty parts; dissolve. Dose, min. v. to min. vj. in some aqueous vehicle three or four times a day. For external use a preparation four times the strength of this may be employed. The *bromide of potassium* and *bromide of iron* will be described hereafter. The other combinations of bromine which are used in medicine are the following:—*Bromide of barium*, which is soluble in water, is given in doses of one to five grains three times a day: the ointment is prepared by combining it with lard, in the proportion of one part to ten. *Bromide of calcium* is prescribed in the form of pill made with conserve of roses; the dose of it is from three to ten grains. Two *bromides of mercury* have been used: the first, a subbromide, is a white insoluble powder; the dose of it is one to two grains daily: the second, a bromide, is fusible and volatile, and soluble both in water and alcohol; its dose is 1-10th of a grain, gradually increased to 1-4th of a grain daily."

In conclusion, we cordially recommend this useful work to our medical and pharmaceutical readers, who will find it a most valuable book of reference.

TO CORRESPONDENTS.

"AMICUS"—We are obliged by your communication, and shall be happy to hear further.

"CHEMICUS."—Your mode of proceedure is generally correct; but reduction of the temperature at which you operate will tend to more uniform success.

"A COUNTRY MEMBER OF THE PHARMACEUTICAL SOCIETY."—The proceedings of the Council are not such as to warrant any confidence being reposed in their desire to obtain at the hands of the Legislature any enactment as to the legal qualification of chemists, nor is the government at all likely to concede any such boon at their solicitation. A movement on the part of the trade, unconnected with the Society, would meet with far greater attention. We are silent for the present on this subject as the government is in a very unsettled state, and when the crisis is over, and a new Ministry is formed, there will be too much work to be got through to admit of the claims of the trade being taken into consideration.

"M. P. S. G. B."—A Chemist; Pharmacien; A Druggist; "M. N.;" "A. P. S.," (Liverpool); "Student;" "M. P. S.," (Manchester); "A Pharmaceutist;" "A. P. S.," (Birmingham); "A Subscriber," (Bristol); and others who write about the legal qualification of Chemists, will please to consider that the above answer applies to their communications.

NOTICE.—*All Communications, Books for Review and Substances for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON THE TARTAR OF THE TEETH.

BY THORNTON J. HERAPATH, ESQ., BRISTOL.

In the case of persons of uncleanly habits, or of those who are much accustomed to public speaking, there is gradually formed around the base of the teeth a hard, bone-like incrustation to which the name of *tartar* has been applied.

This deposit at first consists merely of the mucus of the saliva and small particles of animal and vegetable food, occasionally containing vibriones and monads; but if these are neglected to be removed, inorganic substances are likewise deposited, which in time form a most unsightly concretion, but little inferior to bone in hardness, and often extremely difficult of removal.

The first chemist who appears to have examined this matter was Baron Berzelius.* He found it to be composed in 100 parts of:—

Earthy phosphates	79·00
Mucus	12·50
Salivin	1·00
Animal matter, soluble in muriatic acid	7·50
	100·00

A few years subsequent to the appearance of Berzelius' analysis, another was undertaken by Vauquelin and Laugier. These latter found, besides the matters already specified, a considerable quantity of carbonate of lime and a trace of magnesia. Their results, calculated to 100 parts, are given below:—

Water	7·0
Phosphate of lime, with a trace of magnesia	66·0
Mucus, insoluble in water and acids	13·0
Animal matter, soluble in hydrochloric acid	5·0
Carbonate of lime	9·0
	100·0

A short time since, my brother, Dr. W. B. Herapath, kindly furnished me with a considerable quantity of this substance with the view to its re-examination. The result of my experiments may be summed up as follows:—

The specimen in question was hard and brittle; its external surface was brown and discolored. It possessed a most offensive smell. When cut transversely, no trace of concentric circles or layers could be perceived. When ground to powder and treated with dilute hydrochloric or nitric acid, a considerable effervescence took place, and the solution contained a large amount of earthy phosphates, as was shown by the bulky precipitate which fell upon the addition of an excess of ammonia. The solution, when filtered, also furnished a further precipitate with oxalate of ammonia.

The powdered tartar being digested in boiling water furnished a solution, which possessed a slightly acid reaction. This, when evaporated to dryness, gave a yellowish-colored residue, and exhaled an odor of roast meat. The aqueous extract, thus obtained, was purified from fat by digestion in ether. The residue was found to possess most of the characters of salivin; it also contained a little inorganic matter which was left behind upon incineration.

* *Traité de Chimie* (French edition, 1831), t. vii.

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The organic matter remaining after the tartar had been treated successively with ether, alcohol, water, and dilute hydrochloric acid, was considered as a mixture of mucus and albumen. Thus analysed, the tartar was found to consist of:—

Water	9·000
Fatty matters, &c., soluble in ether	0·600
Substances soluble in alcohol, but insoluble in ether	0·480
Substances soluble in water, but insoluble in alcohol and ether (Salivin or Ptyalin) with some chloride of potassium and sodium	6·306
Carbonate of lime	3·700
Phosphate of lime	63·840
Phosphate of magnesia	traces
Perphosphate of iron, with traces of phosphate of alumina	0·360
Phosphate of manganese	traces
Animal matter, soluble in hydrochloric acid	5·500
Albumen and mucus	10·095
Silica, fine particles of grit, &c.	0·205
	100·086

I also succeeded in detecting a very minute proportion of fluoride of calcium.

Mansion House, Old Park,
Bristol, January, 31st, 1851.

INTRODUCTION TO THE STUDY OF CHEMISTRY.

NO. I.

BEFORE entering into a chemical history and description of the numerous bodies whose existence and properties are known to chemists, it is necessary to make the student acquainted with the nature of that property of matter on which the science of chemistry is based, and which is designated by the term AFFINITY. This we shall do in as few words as possible, feeling that, although some preliminary observations are necessary, it is not imperative to go very deeply into the subject, with which succeeding articles will render him more fully acquainted.

COHESION must not be confounded with affinity. By cohesion, the ultimate particles of matter are held together, and its tendency is to bring the ultimate particles of matter into contact; this, however, is prevented by a counteracting force—repulsion, which renders their immediate contact impossible, and which, by the more or less powerful resistance which it opposes to the action of the cohesive force, performs its part in regulating the form of matter, that is to say, the various degrees of the cohesive and repulsive forces cause bodies to assume the solid, fluid or gaseous form. It is the prevailing opinion that repulsion is due to the agency of heat, which is in some way attached to the ultimate elements of matter, and causes their reciprocal repulsion. In solid substances (example, chalk), the cohesive force predominates over the repulsive, which prevents their particles from moving on each other; in inelastic fluids (example, water), cohesion is considerably less powerful in its influences, and in elastic fluids (gases) cohesion would appear to be entirely absent. Cohesion, therefore, is the force which retains solids and inelastic fluids in their forms, and the absence of which is the cause of the form of elastic fluids.

AFFINITY is the cause of all chemical phenomena. All substances are subject to its influence, but in exceedingly various degrees, and under many modifications. All chemical properties are due to affinity. Affinity is a principle which operates mutually between bodies. Affinity governs the combination of bodies with each other. When two bodies are combined together, as in the case of carbonate of soda, it is owing to the affinity of the carbonic acid and the soda for each other; sulphuric acid has a greater affinity for soda than carbonic acid has; consequently, when it is added to carbonate of soda, the carbonic acid is expelled, and sulphate of soda is formed: the two acids have no affinity for each other. This is termed decomposition. The union of several substances is called combination, the result of which is the production of a new body possessed of properties peculiar to itself, differing from those of its constituents.

Substances are of two kinds—simple and compound. Simple or elementary substances are those which have but one constituent, and which all the endeavors of chemists have failed to decompose. Compound substances are those which are composed of two or more simple substances united by affinity.

Simple substances are 57 in number, according to the present state of our knowledge. It is not, however, impossible but some of these may hereafter be found to be compounds; but as, at present, these bodies have resisted all attempts at decomposition, and, in fact, are undecomposable by known means, we are warranted in regarding their elementary nature as a fact.

The union of two or more simple substances constitutes a compound substance, and we find that this union or combination takes place in certain definite proportions, and in no other, and these proportions are called equivalents, which equivalents are represented by numbers.

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Thus, 1 proportion of hydrogen combines with 8 proportions of oxygen, forming water. The equivalent of hydrogen (which is commonly in England taken as unity, a course which will be followed in these articles) is represented by the number 1, and that of oxygen by 8; the equivalent of the compound, water, is represented by the number 9, which is arrived at by adding together the numbers of hydrogen and oxygen. This, also, is the proportion in which water unites with other bodies. But bodies combine also in other proportions, which are always multiples or submultiples of the equivalent numbers. As an instance of this, we will cite the case of the combinations of the metal chromium with oxygen, and of one of the resulting compounds with potassa. Chromium combines with oxygen in four proportions. Its own equivalent, that is the proportion in which it combines with other bodies, is represented in round numbers by the number 28 (according to Peligot and Moberg it is only 27·8). These proportions are as follows:—

I. PROTOXIDE OF CHROMIUM.

Chromium....	1	equivalent	28
Oxygen.....	1	,,	8
Protoxide of chromium	1	eq.	36

II. SESQUIOXIDE OF CHROMIUM.*

Chromium	1	eq.	28 or 2 eq. 56
Oxygen.....	1½	,,	12 ,, 3 ,, 24
Sesquioxide of chromium	1	eq.	40 80

III. CHROMIC ACID.

Chromium.....	1	eq.	28
Oxygen.....	3	,,	24
Chromic acid.....	1	,,	52

IV. PERCHROMIC ACID.†

Chromium.....	2	eq.	56
Oxygen.....	7	,,	56
Perchromic acid....	1	,,	112

Chromic acid, in its turn, enters into combination with other compounds of oxygen and metals. Potassa is a compound of oxygen, 8, and the metal potassium, 40 (in round numbers), making potassa 48. It is consequently a metallic oxide. Chromic acid combines with potassa in two proportions, forming the *chromate* and the bichromate of that base, the constitution of which is thus represented:—

I. CHROMATE OF POTASSA.

Chromic acid.....	1	equivalent	52
Potassa.....	1	,,	48
Chromate of potassa	1	equivalent	100

II. BICHROMATE OF POTASSA.

Chromic acid.....	2	equivalents	104
Potassa.....	1	,,	48
Bichromate of potassa	1	equivalent	152

Having thus shown that affinity is exerted in accordance with certain laws, and that it is capable of effecting combination only in certain definite proportions, giving rise to compounds which enter into further combination also in obedience to the same laws of affinity which presided over their formation, we shall content ourselves for this month with giving, in conclusion, a table of the simple bodies, or elements, with their equivalents according to the hydrogen scale, that is to say, the scale based on the unity of hydrogen, and likewise according to the oxygen scale, namely that in which oxygen is regarded as 100. We avail ourselves of the table given in Sir Robert Kane's excellent *Elements of Chemistry*. It will be found that the hydrogen scale may be converted into the oxygen scale, by multiplying the former by 12½, and that the latter may be reduced to the former by dividing by the same number.

NAMES OF ELEMENTS. EQUIVALENTS.

	Hydrogen=1.	Oxygen=100.
Aluminum	13·70	171·2
Antimony.....	129·20	1612·9
Arsenic.....	75·00	937·5
Aridium	—	—
Barium	68·66	858·0
Bismuth.....	71·10	886.9
Boron	10·91	136·2
Bromine.....	78·26	978·3
Cadmium.....	55·74	696·8
Calcium.....	20·00	250·0
Carbon	6·00	75·0
Cerium.....	46·05	574·7
Chlorine.....	35·47	443·7
Chromium.....	28·19	351·8
Cobalt.....	29·57	369 0
Columbium.....	184.90	2307·4
Copper.....	31·70	395·7
Fluorine..... ..	18·74	233·8
Glucinum.....	26·54	331·3
Gold	98·33	1229·0
Hydrogen.....	1·00	12·5
Iodine.....	126·40	1579·5
Iridium	98·84	1233·5
Iron.....	28·00	350·0
Lanthanum.....	48·00	600·0

* It is common, in the case of sesquicompounds, to double the number, as is here shown; this is more convenient in some respects.

† The existence of this acid is involved in doubt.

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Names of Elements.	Equivalents. Hydrogen=1.	Oxygen=100.
Lead	103·73	1294·5
Lithium	6·44	80·3
Magnesium	12·69	158·3
Manganese	27·72	345·9
Mercury	100·00	1250·8
Molybdenum	47·96	598·5
Nickel	29·62	369·7
Nitrogen	14·00	175·0
Osmium	99·72	1244·5
Oxygen	8·00	100·0
Palladium	53·36	665 9
Phosphorus	32·00	400·3
Platinum	98·84	1233·5
Potassium	39·00	487·5
Rhodium	52·20	651·4
Ruthenium	52·10	651·4
Selenium	39·63	494·6
Silicon	21 35	266·8
Silver	108·00	1350·0
Sodium	22·97	287·2
Strontium	43·85	547·3
Sulphur	16·00	200·0
Tellurium	64·25	801·7
Thorium	59·83	744·9
Tin	58·92	735·2
Titanium	24·33	303·6
Tungsten	94·80	1183·0
Vanadium	68 66	856·9
Uranium	60·00	750·0
Yttrium	32·25	402·5
Zinc	32·51	406·6
Zirconium	33·67	420·2

CONTRIBUTIONS TO THE HISTORY OF MANGANIC AND HYPERMANGANIC ACIDS.*

BY MM. PERSONNE AND LHERMITE.

When a mixture of caustic potassa and peroxide of manganese has been subjected to the action of heat, the residue, treated with water, gives a liquor of a very deep apple-green color. Exposed to the contact of the air, this solution acquires a magnificent purple tint, passing through all the shades resulting from the mixture, in infinitely varied proportions, of the initial and final colors, whence the name of mineral chamelion given to this singular body by its discoverer, the illustrious Scheele. Among the scientific men who have investigated this matter, we may mention MM. Chevreul, Chevillot and Edwards, Forchammer, Frommherz, Unverdorben and, finally, Mitscherlich.

In a memoir published in 1817, M. Chevreul, having proved that the acids caused the green chamelion immediately to turn red, and that, by the action of caustic potassa the purple solution was returned to apple-green, inferred that a peculiar acid must exist in the two compounds, in which the proportion of the base alone varied.

Soon afterwards, MM. Chevillot and Edwards obtained red chamelion in the crystallised state, and demonstrated that it must contain a more oxygenous acid than green chamelion, since the latter is formed when a solution of the former is exposed to contact with mercury; that, besides, the quantity of potassa necessary for effecting the same transformation was very considerable, since it requires no less than 100 parts of hydrate of potassa to suddenly change to green the concentrated solution of 1 part of crystals of red chamelion.

In 1830, M. Mitscherlich crystallised the green chamelion, and, from analyses which he made of both, he found in the acid of the green salt, which he called manganic acid, three equivalents of oxygen to one of manganium, and one of potassa; and in the acid of the red chamelion, which he called hypermanganic acid, seven equivalents of oxygen to two of manganium and one of potassa. This composition is now denoted by the formula $PoO\,MnO^3$ for the green salt or manganate of potassa, and PoO, Mn^2O^7 for the red salt or hypermanganate of potassa.

M. Mitscherlich estimated the oxygen of the hypermanganate of potassa by submitting this salt to the action of nitric acid. In these conditions, the hypermanganic acid is set at liberty, and a slight elevation of temperature, which is partly contributed to by the reaction, is sufficient for effecting its decomposition into oxygen, which is disengaged and collected in a bell-glass receiver over mercury, and into binoxide of manganese, which is deposited in the vessel. The potassa combines with the nitric acid and is estimated as nitrate of potassa.

We have ascertained that there are two chances of error in this operation, one inherent to the other, and depending on the production, almost always, if not always, of a certain quantity of nitrate of protoxide of manganium.

The fact once established,* it is easy to understand that, on one hand, the oxygen will be estimated too high, and that, on the other hand, the weight of the nitrate of protoxide of manganese will be added to that of the nitrate of potassa, so as to maintain apparently the real proportions of the base and the oxygen of the acid.

Having some doubts as to the composition assigned to the bodies under consideration, and having shown the existence of a cause

* *Journal de Pharmacie*, Feb., 1851.

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of error, especially in the determination of the oxygen, we sought for another means of estimating this element.

We adopted, reversing it, the process employed by M. Bussy for the estimation of arsenious acid. It is known that M. Bussy's process, which is derived from that employed by M. Marguerite in the quantitative determination of iron, consists in determining the volume of a crude chamelion liquor which a given weight of arsenious acid can decolor; so that, having afterwards to estimate the quantity of the latter body contained in a solution, we have only to pour into it, after properly acidulating it, red chamelion until a violet tint is produced; a simple calculation will then show the weight sought for.

Having to act only on perfectly definite bodies, the balance was only used in our preliminary determinations. We take any weight of dried permanganate, and an equally arbitrary weight of arsenious acid, and make with each of these bodies a pint or a quart of solution.

The arsenious solution should be so strongly charged with hydrochloric acid as to render the decomposition of the salt prompt, and for the oxide of manganese to remain in the solution nearly colorless. A demi-decilitre of this solution is put into a Gay-Lussac's test-vessel, and the red liquor is then poured in by means of the graduated burette, at the same time giving to the liquid in the vessel a rotary motion. The color of the permanganate instantly disappears. When it begins to give an olive shade, it is necessary to be on our guard, to agitate briskly, and, on the manifestation of a slight rose tint, to stop. The vessel is covered with a bell-glass. After some time, all coloration has disappeared, and a slight odor of chlorine indicates that the last drop added was too much, and that it must be deducted.

Nothing is more easy now than to analyse the phenomena which occur here, and to calculate their results. On contact with hydrochloric acid, the permanganate of potassa is decomposed, the base is converted into chloride of potassium, the acid itself becomes protochloride of manganese, and a certain quantity of oxygen, set at liberty, is employed to convert the arsenious acid into arsenic acid. It is clear that, looking at the nature of the reaction, concerning which it would be idle to insist here, that this efficient quantity of oxygen is only the difference between the whole of that which the decomposed salt contained and the proportion which is necessary for constituting the potassium and the manganium in the state of protoxides.

The estimation of the potassa and manganese will make known this proportion. The following is the way in which we calculate the other, namely, that which has been used in converting the arsenious acid into arsenic acid.

Let p represent the weight of arsenious acid employed for making a quart of liquor; we take of it half a decilitre, i.e., $\frac{p}{20}$ of acid. Now, the equivalent of arsenic being 75 (H=1), the equivalent of arsenious acid will be 99, that is to say, 75 + 3 times the number 8, which represents the equivalent of oxygen: and as it requires two additional equivalents, or 16 parts of oxygen, to form it into arsenic acid, for calculating the quantity of oxygen which our half decilitre will absorb, we have the following proportion:—

$$99 : 16 :: \frac{p}{20} : x \quad \left\{ \begin{array}{l} \text{the quantity of oxy-} \\ \text{gen sought for.} \end{array} \right.$$

The following are the experiments we have made:—

I. 50 cubic centimetres of an arsenious liquor, made with 4·44 grammes per quart, required 35cc.5 of a solution containing 1·148 gramme of hypermanganate of potassa in half a pint.

II. 15cc. of an arsenious liquor at 10 grammes per quart required 21cc.7 of the solution at 1·148 gramme per half pint.

III. 50cc. of an arsenious liquor at 2·213 grammes per quart required 18cc.9 of a liquor of hypermanganate at 3·8088 per quart.

By calculating as we have indicated the quantity of oxygen yielded to arsenious acid, and finding, by calculation, the weight of salt used at each testing, we find that, for 100 parts of hypermanganate of potassa, the oxygen yielded amounts to

I.	II.	III.	Means.
25·6	24·33	24·8	24·91

The estimation of the potassa and manganese furnished the following results:—

I. 1·1335 grammes of salt gave 0·55 of oxide Mn^3O^4.

II. 1·7115 of hypermanganate of potassa gave 0·825 of sulphate of potassa and 0·854 of oxide Mn^3O^4.

III. 1·831 of salt gave 1·043 of sulphate of potassa, and 0·928 of oxide Mn^3O^4.

IV. 1·653 of salt gave 0·842 of sulphate of potassa, and 0·803 of oxide Mn^3O^4.

V. 2·023 of salt gave 0·978 of oxide Mn^3O^4.

These numbers correspond, in 100 parts of salt employed, to—

	I.	II.	III.	IV.	V.
Oxide MnO..	45·14	46·42	46·15	45·1	45·02
Potassa.....		26·49	29·98	27·58	

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All these cyphers agree with the composition admitted by M. Mitscherlich. The potassa alone is estimated a little too low, but not sufficiently to lead to any other formula than this: PoO, Mn^2O^7.

The following, in hundredths, are the quantities which the calculation based on this formula gives—

Protoxide of manganese 2(MnO)	45·0
Potassa PoO	29 8
Oxygen 5O	25·2
	100·0

When the red permanganate of potassa is exposed to the action of heat, by means of a tube closed at one end and dipping into an oil-bath, it undergoes no alteration until it has reached 446° F. At this point, it begins to crackle, and if care has been taken to put the vessel which contains it in communication with a receiver placed over mercury, it is perceived that gas is disengaged. The degree which we indicate is necessary for commencing the action; we have maintained the salt for hours at the temperature of 435 to 437° F., without obtaining a trace of gas; but, when once commenced, the decomposition continues even when the temperature descends below 437° F.

MM. Chevillot and Edwards, in operating on a sand-bath, had observed that the decomposition commenced between 437 and 446° F., but did not remark the peculiarity which we have noticed. If the temperature of the bath be raised, the decomposition proceeds too quickly, and a portion of the matter is projected into the tubes of communication. Also, when it is wished to estimate the products, it is necessary to attain the temperature of 446° F. only very slowly, and to remove the heat as soon as the first crackling is heard. It is only necessary to take care to maintain the temperature at 435 to 437° F. When noise is no longer produced, the heat may without inconvenience be carried to 572° as rapidly as desired. The quantity of oxygen which is obtained, when the heat is maintained between 437 and 464° F., is about 12 per cent.; it does not increase sensibly between 464 and 572° F., but increases a little by substituting for the bath the flame of a spirit-lamp with a double current of air. In no case was there the smallest trace of water. If the residues obtained at these various temperatures be treated with water, green chamelion is always dissolved.

But these residues put into a small porcelain crucible, and this crucible put into a larger one, and exposed to the heat of a reverberatory furnace, give a product which does not color water. Every trace of chamelion has disappeared. The weight of the matter has increased, because the potassa then acquires more carbonic acid than the manganese loses of oxygen.

We must not omit to mention that the analyses of permanganate which have been made, not excepting our own, still leave doubt in certain respects: we allude to the problematical composition of the oxides of manganese furnished by calcination.

When the carbonate or the peroxide of manganese is submitted to the flame of a lamp with a double current of air, we obtain as a residue an oxide possessing the brown-red color which is attributed to the oxide Mn^3O^4, but M. Mitscherlich assures us that it still contains an excess of oxygen. When calcined in a reverberatory furnace, after having placed the platinum crucible containing it in a Hessian or porcelain crucible, it becomes blacker and loses in weight. When we remember that M. Berthier has prepared the protoxide of manganese by calcining the more oxygenous oxides of that metal in a brazed crucible, it will very naturally be asked if the oxide of carbon of the reverberatory furnace may not operate a partial reduction of the oxide Mn^3O^4 itself.

We have indeed, it is true, sought for a control in the transformation of the calcined oxide into sulphate of protoxide of manganese, but has it been ascertained that the heat necessary for driving off the excess of sulphuric acid has not been sufficient for peroxidising a portion of the base?

We think that we are on the track of a convenient means of verifying the composition of the oxides of manganese: it is an imitation of M. Levol's process for the estimation of copper in the solutions of cupreous salts.

If we put into a stoppered flask some oxide of manganese, a clean and weighed sheet of copper, and dilute sulphuric acid, prepared with water deprived of air; and if, the vessel being exactly filled, the neck be covered externally with a mixture of tallow and wax, the following phenomena will be observed:—After some hours, the liquor turns blue in the vicinity of the oxide of manganese; if it be agitated, the blue color disappears, lost in the brown tint which the oxide communicates to the liquid; but this oxide is very promptly deposited, leaving the liquid limpid and colorless, and the blue tint reappears afterwards at the bottom of the vessel, until the whole of the oxide is dissolved, when the azure tint, which continues for some time after it, vanishes in its turn.

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Is it necessary to say what takes place here? The sulphuric acid dissolves at once a certain quantity of oxide of manganese and some oxide of copper formed by the excess of oxygen of the portion of oxide of manganese which has been attacked. The oxide and metal here lend mutual assistance in order to enter into solution.

The sulphate of oxide of copper is colorless; but, having a considerable attraction for oxygen, it acquires some by aid of the oxide of manganese, and becomes blue, and again becomes colorless on contact with the metallic plate.

It will therefore be conceived that if we weigh the copper plate when all has disappeared, color as well as precipitate, by the loss of weight we shall be able to know directly the quantity of copper which is dissolved, and consequently to calculate the quantity of oxygen removed from the oxide of manganese. There will then remain, in assigning to the oxide employed its true composition, no other uncertainty than may be referred to the equivalent of manganese.

ON THE PROPERTIES OF THE PERMANGANATE OF POTASSA.

We have already indicated the action of heat on this compound; we have said, and the fact had been proved before our experiments, that at the moment of its decomposition a little noise is heard. Is this the effect of the decomposition itself? Is it nothing more than a series of little detonations resulting from the sudden production of a gas? This is what presents itself first to the mind. The action of water, however, tends to weaken this explanation. When cold, this liquid does not give rise to any other perceptible phenomena than the formation of a purple liquor, essentially dichroite, even when the salt is perfectly pure. But when hot water is poured on the crystals, a noise similar to that made by oxalic acid in the act of solution is made. In the case of oxalic acid, we have, it is true, an explanation of the noise by admitting the disengagement of nitrogenous gases which the acid, formed at the same time as they are, had imprisoned at the moment of the formation of the crystals; but besides that it would be difficult to justify such an explanation with regard to hypermanganate of potassa, we really do not see the necessity of having recourse to it. However little one may have studied the properties of crystals, to our knowledge of which M. Mitscherlich has contributed so greatly, we are soon convinced that a crystal is a system, all of whose parts, solid among themselves, are strictly in stable equilibrium only in the general conditions and especially in the circumstances of temperature in which the crystal is formed. When these conditions are changed in any degree, we see the edifice crumble, and its remains, in knocking together, give rise to the phenomena of which we are speaking.

According to this view, which has the advantage of explaining two facts at once, the decomposition would be an act consecutive to the destruction of the crystals.

As regards the resistance which would oppose the salt in a first attack, after which it would yield its elements to a more easy separation, it may to a certain extent be accounted for by considering that the oxide of manganese, one of the products of this action, suddenly disengages, without heat, the oxygen of the oxygenated water, and facilitates the decomposition of the chlorate of potassa by heat.

We obtained permanganate of potassa in two different forms from its solution in water. By cooling, needle-shaped crystals are obtained; it is these that have always hitherto been observed: its spontaneous evaporation, at the ordinary temperature, gives octohedra with a rectangular base belonging to the right rectangular prismatic system.

Hypermanganate of potassa dissolves in monohydrated sulphuric acid, and gives a very deep green liquor, whose slight green tint, viewed in a thin layer, greatly resembles that which the solution of chlorophylle in the same acid presents. If this liquor be diluted with water, it becomes purple-red, the ordinary color of hypermanganic acid and the hypermanganates in solution in water. When the green sulphuric solution is slightly heated on the sand-bath, oxygen is disengaged in large quantity, as well as purple vapors, which condense in the solid state on the upper part and in the neck of the retort in which the operation is performed.

After separating the belly from these two parts, the purple substance which it contains may be treated directly with water: hypermanganic acid is dissolved, but peroxide of manganese always remains attached to the sides of the vessel. If we had not been aware of the instability of the acids of manganese, we should have endeavored in the first instance to explain the action of the vehicle by considering that the condensed product was manganic acid, which, on contact with water, separated into binoxide of manganese and hypermanganic acid. But in this hypothesis, the caustic potassa should be entirely dissolved, whilst it leaves itself a residue of oxide of man-

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ganese. In the absence of any analysis, analogy of properties and similarity of composition should be regarded as connected. Now chloric acid is decomposed by heat, and perchloric acid may be distilled.

This volatility of hypermanganic acid adds another doubt to those already existing relative to the true composition of the product obtained by M. Dumas, in acting with sulphuric acid on a mixture of chamelion and fused sea-salt. We have ascertained, however, that the hypermanganic acid which is disengaged from a mixture of mononydrated sulphuric acid and dried hypermanganate of potassa, is much less volatile than M. Dumas' perchloride. Like it, it is much less colored in the absence of water.

The following experiment tends to prove that the red matter is a hydrate:—Into a tubulated retort were put about 30 grammes of hypermanganate of potassa, and monohydrated sulphuric acid was poured on: after a few seconds, the atmosphere of the vessel presented a cherry-red tint; the belly of the retort was placed on a sand-bath, the temperature of which was slowly raised to 122° F. The dome and the neck were covered with a solid layer of a deep red, which, thin as the layer was, was completely opaque. The retort was removed, the neck corked, and left to itself for 8 or 10 days. After this lapse of time, the opaque layer had disappeared, and was replaced by a disconnected and very light grey layer, except at the extremity of the neck, which still presented the primitive tint for the extent of two or three centimetres.

The retort was cut to separate the belly from it; the dome and the neck very quickly attracted moisture and were covered with a red liquid. A portion of the dome was separated and subjected to the action of a moderate heat: thick white vapors were disengaged from it, and left a green color. The formation of this green color was probably owing to the presence of sulphuric acid, which seems to give a product of this color with hypermanganic acid.

We proved the presence of sulphuric acid in the neck and dome of the retort.

Perhaps sulphuric acid also gives this color with another degree of oxidation of manganese. This supposition is warranted by the fact that the solution of the manganate or hypermanganate of potassa in hydrochloric acid becomes green before becoming colorless.

We ought to state that caution must be used in making a mixture of sulphuric acid and hypermanganate of potassa. When sulphuric acid which is not very concentrated is employed, the decomposition of the salt into potassa which unites with the sulphuric acid, into binoxide of manganese which deposits, and into oxygen which is disengaged, is much more prompt.

If we take monohydrated or slightly diluted acid and undried salt, the water of the latter, uniting with the acid, gives rise to the production of heat sufficient for causing an explosion at each effusion of acid. Hypermanganic acid being unable to exist in these conditions, cannot be formed in them.

Even when operating as accurately as possible, putting monohydrated and pure acid on dried crystals of permanganate of potassa, and exposing the mixture to the heat of a water-bath, we incur the risk of a very violent explosion, with emission of light, even if the temperature be very slowly raised.

The instability of hypermanganic acid is the great obstacle to its production in sufficient quantity for investigation. In the best conducted operations, only insignificant quantities are obtained. The greater part is decomposed into oxygen and binoxide of manganese.

(To be continued.)

ON LOBELINA, THE ACTIVE PRINCIPLE OF LOBELIA INFLATA, AND ON SOME OTHER PROXIMATE PRINCIPLES OF THE SEED OF THAT PLANT.*

BY MR. WILLIAM PROCTER, JUN.

In the ninth volume of this Journal (1838) was published an essay on *Lobelia inflata*, by the author of this communication, which embraced a chemical analysis of the plant. According to that analysis, the following named substances were contained in the plant, viz.—*gum, gallic acid, resin and chlorophylle, fixed oil, a peculiar acrid alkaline principle, salts of lime and potassa, oxide of iron and lignin.* It was stated that the active principle of the plant was destroyed or injured by much heat, without determining the cause of the phenomenon, or exposing the peculiar circumstances under which it happened.

This active principle was described as possessing alkaline properties, as capable of forming crystalline salts with acids, and as having a brown color and semifluid consistence. The sequel will demonstrate the conditions under which this active principle is affected by heat, and the means of rendering

* *American Journal of Pharmacy.*

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it permanent, as well as exhibit a more detailed description of the principle itself.

In volume 5th, page 300 of this Journal, is an essay "*On Lobelia, the active principle of Lobelia Inflata*, by S. Colhoun, M.D.,* Professor of Materia Medica in Jefferson Medical College." At the period that my former essay was written, this paper by Dr. C. was cursorily examined, but the fact that his active principle was *insoluble in ether*, at once caused a belief that the principles were different, and that, that contained in my essay, was unique. A subsequent and more critical examination of Dr. C.'s paper has led to the conclusion that he did not succeed in isolating lobelina, but that his principle was an impure hydrochlorate of that base, as is evident from the following extract from his paper, viz. :—

"The process by which this active principle was obtained, was first by dissolving it in acidulated water; muriatic acid being used for this purpose, the menstruum continued to act on the leaves for seven hours; it was then evaporated, the heat separating the superfluous acid.

"Crystals, on the fluid being sufficiently reduced, were discovered on the bottom of the vessel; they were mixed with some foreign earthy salt, the existence of which was proved by burning the substance remaining after the evaporation, in a small bottle kept for some hours in a red heat.

"To avoid the salts thus formed with the acid, alcohol was used as the solvent; the extract remaining after its evaporation was beautifully transparent, and had the other properties above described. [Alluding to a previous description.] It was this extract that was principally used to form salts with the acids."

From these remarks, it is evident that the substance described as lobelina was really a mixture of the hydrochlorate of that base, with such other matter as alcohol will extract from the watery extract of *Lobelia inflata*. Hence this *principle* could not have had an *alkaline reaction*, and there is no mention made in the paper of its possessing this reaction. It states that "lobelia [lobelina] *forms salts* with the acids," not that it *neutralises* acids; and consequently we are led to believe that the salts of Dr. C. were mixtures severally of the acids which gave them names, with the impure hydrochlorate of lobelina.

* An acknowledgment was due to Dr. Colhoun for omitting a notice of his paper in the essay before mentioned. Since the present essay has been prepared, we lament to state that his death has occurred.

Speaking of the active principle, the doctor remarks, "It is very soluble in alcohol; *scarcely, if at all, in ether*: in this respect it differs from nicotine: the active principle of *Lobelia inflata does not even color ether to which it has been added*." This declaration is a further evidence that the active principle of Dr. Colhoun was not lobelina, *for of all the solvents of that base, none dissolve it so readily as ether*; and as Dr. C.'s principle was insoluble in that menstruum, it follows that, if lobelina, it must have been combined with an acid, in which state it is much less soluble in ether.

In a work on Materia Medica, by Jonathan Pereira, Professor of Materia Medica, &c., &c., at London, published in 1840, is the following under the head of *Lobelia inflata*, viz. :—

"*Composition.*—No accurate analysis of this plant has hitherto been made. Dr. Colhoun has announced the existence of a peculiar principle in this plant. From some experiments I have recently made on lobelia, I find that it contains *a volatile acid principle* (oil?), and acid (peculiar?), resin, gum, &c., &c.

"*Vol. Acrid Principle.*—Water distilled from lobelia has the peculiar smell and nauseous acrid taste of the plant. In one experiment I obtained a thin film, of what appeared to be a solid volatile oil. The distilled water is unaffected by acids, sesquichloride of iron, or tincture of galls.

"*An acid* (lobelic acid?).—A decoction of lobelia reddens litmus, and becomes, on the addition of sesquichloride of iron, of a dark olive brown, and in a short time a precipitate is formed (lobeliate of iron). Sulphate of copper gives rise to a green precipitate (lobeliate of copper). Nitrate of silver causes a slight precipitate (lobeliate of silver)."

The object for which the above extracts are inserted is to notice their contents in detail.

1st. Professor Pereira states that he has obtained a *volatile acrid principle* from the *Lobelia inflata*, which he infers to be an oil. By reference to experiments 4th, 5th, and 6th of my former essay on this subject, it will be seen that this point has been fairly tested. A saturated tincture of the leaves of lobelia was distilled, and the product was found to possess the odor, but *not* the acrid taste of the plant. Again, lobelia was subjected to distillation with water, and the distilled liquid returned upon a fresh portion of the plant, but the result was merely an odorous water, without any acrimony, or any taste that could be said to approach it.

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To place this matter in a clear light, the experiments just mentioned (which were originally intended to prove the presence of a *volatile odorous principle*, but not a *volatile acrid principle*) were repeated; lobelia was distilled and redistilled, but the results have been as above detailed; hence, the inference follows, that some accidental cause must have influenced the product of Professor Pereira.

2d. With regard to "lobelic acid" little can be learned from Professor Pereira's remarks above quoted. By referring to the first page of this article, it will be seen that the acidity of the decoction of lobelia was attributed to gallic acid. From an extended inquiry into the nature of this acid, which will be found in the sequel, it appears to be peculiar to the plant, but very like gallic acid in several of its reactions, which accounts for its having been mistaken for that acid. With these preliminary remarks, which have been made in justice to my own, and to the essays of the gentlemen respectively to whom they apply, the regular matter of this paper will be resumed.

FIXED OIL.

One ounce of the seed of *Lobelia inflata*, finely bruised, was macerated in two fluid ounces of sulphuric ether, 54° Baumé, for eight days, with occasional agitation. The ethereal liquor was then decanted, and the seed placed on a displacement filter, and treated with ether until exhausted. This product was mixed with the first, and allowed to evaporate spontaneously. Two drachms and a half of a green fixed oil were thus obtained. Besides this oil, about twenty grains of a brown substance was left after the evaporation of the ether, held in solution by the alcohol contained in the ether. This substance had an extremely acrid taste, owing to its containing a portion of the natural salt of lobelina. The green color of the oil is due to chlorophylle, derived from minute portions of the leaves of the plant being mixed with the seeds.

A portion of the seed finely bruised was subjected to pressure, surrounded by bibulous paper; and the latter, after the removal of all extraneous matter from its surface, was macerated in ether, which was subsequently evaporated. The oil thus obtained has very little color, and by exposure becomes limpid. Its specific gravity is ·940°. The most prominent quality of this fixed oil is a tendency to the rapid absorption of oxygen, and hence it is one of the drying oils. So much is this the case, that a portion of oil in a shallow capsule became solid in two weeks, and when removed from the vessel had the appearance of gum arabic. A small quantity of white paint was prepared with this oil, and it was found to dry even more rapidly than linseed oil. The seeds contain about thirty per cent. of fixed oil.

RESIN.

When a tincture of the seeds made with alcohol 30° B., is evaporated, a brown colored substance gradually precipitates, which, when dried, has the characters of resin.

GUM.

A decoction of the seed of lobelia is precipitated abundantly by subacetate of lead, but is not affected by solution of iodine, gelatine, or ferrocyanuret of potassium.

LOBELIC ACID.

A decoction of the leaves of lobelia is precipitated dark olive brown by sesquichloride and persulphate of iron; green by sulphate of copper; deep brown by nitrate of silver; reddish brown by lime and baryta waters, and is not affected by pure soda or the chloride of calcium or barium. From the peculiar effects of metallic salts on the decoction, Professor Pereira inferred the presence of a peculiar acid, which he designated *lobelic acid*, in case future experiment should prove its claim to the title.

One ounce of lobelia leaves in powder was boiled in half a pint of water for half an hour; when cold, the decoction was filtered, and sulphate of copper added as long as it caused a precipitate. This was collected on a filter, and washed with water until the washings ceased to taste or evince an acid reaction with litmus paper. This precipitate was suspended in water, and a current of hydrosulphuric acid was passed through the mixture, until from a green, its previous color, it had assumed a uniform deep brown hue, when it was gently heated and filtered. The brown precipitate was principally sulphuret of copper.

The filtered liquor had an acid reaction, and was evaporated carefully to dryness, yielding a dark colored extract. This was treated with boiling ether, and the ethereal solution allowed to evaporate to dryness spontaneously. A mass of a yellow color and semi-crystalline texture was obtained, which instantly turned the blue color of litmus to red when applied to it in a damp state. By treating this product with cold ether and evaporating, the acid is obtained purer and in imperfect crystals. In this state, lobelic acid, when in solution, is precipitated light green by sulphate of copper; olive brown by persulphate of iron; yellow by acetate of lead; yellow by baryta water, and grayish-white by nitrate of mercury. It is not precipitated by chloride of barium.

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THE ACTION OF HEAT ON THE ACTIVE PRINCIPLE OF LOBELIA INFLATA.

Six ounces of lobelia seeds, in a bruised state, were macerated in twelve fluid ounces of water, acidulated with two drachms of acetic acid, for three days, the infusion pressed out, saturated with magnesia, and filtered. This solution had a dark greenish color, and a very acrid taste. One half of it was put in a capsule on a water-bath, and evaporated to dryness. The extract thus obtained was *entirely without the acrimony* peculiar to lobelia, and which was so strongly manifested by the infusion previous to subjecting it to heat. The other portion of the infusion was treated with ether, and the ethereal liquor separated and permitted to evaporate. The product had a powerful acrid taste and alkaline reaction.

It was observed that the residue in the retort, after distilling water from lobelia seeds, possessed some acrimony; and consideration suggested the idea, that as the active principle was in that case combined with an acid, its presence might exert an influence in preserving the lobelina from decomposition. In accordance with this view, the following experiment was executed:—

Two drachms of bruised lobelia seeds were macerated in two ounces of water, to which five drops of sulphuric acid were added, for three days, and filtered. This liquor, which had a light brown color and acrid taste, was divided into two equal portions, A and B. A was put into a retort, to which a receiver was adapted, and heat applied until three fifths of the liquor had distilled. On examination of the product and residue, the former had the odor of lobelia, but was tasteless; the latter in the retort was much more acrid than the original infusion, having really *all* the acrimony of the quantity subjected to distillation.

The infusion B was saturated with magnesia, filtered and distilled as before, until three-fifths had passed over. The product resembled that of A. On examining the residue in the retort, it was found to have *entirely lost its acrimony*.

To ascertain if lobelina itself, when freed from those substances that necessarily accompany it in an infusion, was similarly affected by heat, one and a half grains of lobelina was dissolved in an ounce and a half of water, and divided into two equal portions, No. 1 and No. 2. No. 1 was subjected to distillation in a distillatory apparatus until one-third of the liquid had passed over. The product and residue were removed and placed in separate bottles. To No. 2 a small portion of sulphuric acid was added, rather more than sufficient to saturate the lobelina, and afterwards subjected to a similar distillatory process, and the residue and product also separately bottled. On examining the results of the distillation of No. 1, the distilled water had a lactescent appearance, which, by standing, assumed a brown color, and had a bitter taste, but not the slightest acrimony. The residue was opaque, had a brick-red color, and *none* of the peculiar taste of lobelina, but merely a bitterness. The opacity of the solution No. 1 took place soon after the application of the heat to it.

The product of No. 2 was perfectly *transparent*, and had very little odor or taste. The residue was nearly transparent, and more acrid than the original solution before distillation. It may be well to remark that the lobelina used in this experiment was not entirely pure, owing to the presence of some coloring matter, to which the color of No. 1 residue may be attributed.

It follows from these remarks:—

1st. That an acrid infusion of lobelia may be raised to the boiling temperature without losing its acrimony.

2nd. That the condition necessary to bring about this permanence is the presence of an acid, with which the acrid principle will combine.

3rd. That the acrid principle in a free state is decomposed by the heat of boiling water, as it is found in neither the residue or the product when a solution of it is distilled.

LOBELINA.

Twelve ounces of the seed of *Lobelia inflata*, finely bruised, was macerated in twenty-four fluid ounces of alcohol 28° B., acidulated with half an ounce of acetic acid, for three days, and subjected to displacement. This process was continued with dilute alcohol until the seeds were exhausted of their acrimony.

The tincture, amounting to five pints, was evaporated to the consistence of an extract, which weighed an ounce and a half, or one-eighth of the seeds employed. This extract was triturated with an excess of magnesia, and twelve ounces of water gradually added. After frequent agitation for several hours, the liquid was filtered, and the filter washed with water. This solution was then agitated with six ounces of sulphuric ether until all its acrimony was removed. The etherial solution was then decanted, and allowed to evaporate spontaneously in a porcelain capsule. 18·5 grs. (·0035 per cent.) of a reddish-brown matter of the consistence of honey resulted, which instantly restored the blue color of litmus,

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reddened by an acid, and possessed an extremely acrid burning taste.

In this state lobelina contains coloring matter, to deprive it of which it was dissolved in water, and dilute sulphuric acid gradually added until the solution was slightly acid. It was then mixed with purified animal charcoal, boiled, saturated with magnesia, and filtered. This solution was then agitated with ether until the lobelina was removed, and the ethereal solution separated and allowed to evaporate.

As thus obtained, lobelina has a light yellow color, and somewhat aromatic odor. It is lighter than water,* and when dropped into that fluid rises to its surface, spreads out like a drop of oil, and gradually dissolves without agitation, forming a transparent solution. If the process of purification were repeated, there is little doubt but that the lobelina would be obtained perfectly colorless.

Lobelina, in solution, is precipitated instantly as a white bitannate by tannic acid, and is not disturbed at all by gallic acid, corresponding in this particular with the other vegetable alkalis. Its solution forms a white precipitate with nitrate of silver, which becomes deep brown by standing; persulphate of iron does not at first affect the transparency of its solution, but gradually a brown precipitate falls; acetate of lead causes a white precipitate; bichloride of mercury does not produce any change.

When lobelina is placed in contact with concentrated nitric or hydrochloric acids, it is merely dissolved, without undergoing any change, and when diluted the acrimony is found unimpaired; but when acted on by sulphuric acid, it is first blackened, then dissolved, and loses its acrid taste.

Lobelina is soluble in water, but not near as readily as in alcohol and ether. When its alcoholic solution is poured into water, the mixture is at first cloudy, but by agitation it gradually becomes transparent. Ether readily removes lobelina from its aqueous solution. Oil of turpentine and oil of sweet almonds also hold it in solution when allowed to remain in contact with it for a short time.

SALTS OF LOBELINA.

A portion of lobelina was dissolved in water, and hydrochloric acid gradully added, until the solution ceased to have an alkaline reaction. The solution was then allowed to evaporate spontaneously, and the *hydrochlorate of lobelina* obtained in four-sided prisms, terminated by pyramids.

The *sulphate* was obtained in a similar manner by employing sulphuric acid. It crystallises in acicular crystals radiating from centres, but they were too small to admit of their shape being distinguished correctly.

The *nitrate* also crystallises in prisms of irregular shape.

The *oxalate* crystallises in minute silky needles.

The *lobeliate* of lobelina was also obtained in a crystalline form, but the difficulty of isolating the acid in a perfectly pure state prevented the salt from exhibiting perfect crystallisation.

The salts of lobelina are more soluble in water than the alkaloïd itself. They are also soluble in alcohol and less so in ether. They do not possess any odor, but, when tasted, exhibit all the acrimony of the base.

To ascertain if lobelina was really the *active principle*, one-fourth of a grain of that substance in solution was administered to a cat. In less than two minutes it produced violent emesis and much prostration, from which the animal fully recovered in three hours.

Again, one grain of lobelina in one fluid ounce of water was administered directly into the stomach of the animal by an elastic tube. Immediate and total prostration was the consequence, which for half an hour rendered the animal almost motionless—the pupils of the eyes were much dilated. The animal gradually recovered its strength, but the effects of the prostration were evident for fifteen hours afterwards. No emetic or cathartic effects resulted, and the long-continued narcotic action of the substance may be attributed to its remaining in the stomach. Other symptoms of narcotic action were evident, which it is unnecessary to mention. From these remarks, it is evident that lobelina is *not* so active an agent as nicotine.

* Lobelina was formerly stated to be rather heavier than water, which was owing to the improved state in which it was obtained.

ON ALOINE, THE CATHARTIC PRINCIPLE OF ALOES.*

BY MESSRS. T. AND H. SMITH.

DURING last summer, having occasion to prepare a quantity of the aqueous extract of aloes, a preparation in repute with many medical men, we made use of cold rather than hot water as the solvent, from an

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impression that a more perfect, though less bulky product would be obtained by leaving in the marc a large proportion of resinous matter, which must necessarily be contained in the extract prepared from a hot solution. Further, with a view of rendering the preparation as perfect as possible, the filtered liquid was evaporated *in vacuo*, thereby avoiding an excess of heat, under the influence of which and exposure to the air, recent researches show the cathartic property of the aloes to be seriously impaired.

After the syrupy liquid had cooled, certain appearances arrested our attention, and seemed of sufficient importance to induce a departure from the original intention of forming it into a dry extract. The vessel containing the thin extract was now therefore set aside for a few days; and when again examined, the contents were found to have lost their original liquid state, and to have become loaded with a mass of granular crystalline matter. The whole was at once put into a cloth, and freed from the liquid portion by strong pressure. The crude solid substance left in the cloth being very impure, required further treatment before an opinion as to its nature could be formed, and was therefore dissolved in hot water, and filtered while still hot, out of contact with the air. On the cooling of the liquid, the substance separated in a crystalline state and of a deep yellow color. After a second pressure, it was subjected to another treatment exactly like the last. The solid cake resulting from the third pressure, after being completely dried, presented the appearance of an opaque straw-yellow mass, breaking short and of a dull fracture. Its taste was intensely bitter and distinctly aloetic, but entirely without smell. It was found to be quite combustible, and to leave no ash on being burned on platinum foil. Its solution acted on test-paper neither as an acid nor an alkali; it was therefore a neutral body. It dissolved in very small quantity in cold water, not above a grain to the ounce, but very readily when heated. It is very soluble in acetic ether, and also in acetic acid, of about 25 per cent., even in the cold; 4 grs. may be easily dissolved in a fluid drachm of either of these liquids. In lime-water it is considerably more soluble than it is in cold distilled water. Oil of turpentine and chloroform do not appear to have any solvent action on it. It is very readily dissolved by aqua potassæ and other alkaline liquids. In rectified spirit, with the assistance of heat, it dissolves in large quantity; and on very slowly cooling, out of contact with the air, it crystallises in beautiful yellow satiny tufts of rhombic plates. The spirituous solution however refuses to give crystals unless above 40 grs. to the fluid ounce of spirit be used. It is therefore very soluble in this menstruum, 12 parts by measure being capable of holding 1 part in solution. Weak spirit is also a good solvent, for on adding water to a strong alcoholic tincture, there is no separation. Sulphuric ether dissolves it very sparingly.

From a consideration of all these characters, we became satisfied that the substance which had been separated by us from the commercial Barbadoes aloes had never been made known before, and therefore was a new substance; but whether the interest attached to it should terminate here remained to be seen. Of course the first and most important question which suggested itself to the mind, and which remained to be solved, was—Whether the crystalline substance which we had now convinced ourselves was an educt, and not a product, from the aloes, possessed any of the virtues of aloes as a medicine, or whether the virtues of aloes were concentrated in it, and depended on its presence for their action upon the living body.

The first trial, with the view of ascertaining its action on the body, was made with ½ a grain, and it acted twelve hours after being taken, in the manner that so characteristically distinguishes the action of aloes. The same quantity was again given to two healthy young men, with a similar result, except that in one about twenty-four hours elapsed before its operation. In the next two cases, 1 gr. failed to act; but in one of these, the dose having been increased to 2 grs., a very strong operation was the consequence. In a case where 4 grs. were given, the person, a patient of Dr. Robertson, Physician to the Edinburgh Royal Infirmary, had been taking ¼ gr. doses of elaterium with little effect. The operation in this case was rather violent. In numerous other cases in which it was tried, it invariably operated in doses of from 1 to 2 grs. The result of these trials was the removal from our minds of every doubt of the crystalline body yielded by the aloes being that on which the cathartic action depended, being in fact the active principle of the drug.

To the new crystalline substance we have given the name of aloine. It was obtained, as already stated, from Barbadoes aloes; and it became a question, both interesting and important, to ascertain whether it could be procured from other kinds, such as the Socotrine and Cape. With this view we therefore put these two kinds of aloes under

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treatment, operating in the very same way as with the Barbadoes, but without success. That the aloine is present in both of these sorts there cannot be a doubt.* In fact, we have no hesitation in stating our belief, that we shall yet obtain it from these, the result of what little we have done convincing us of its existence in them as well as in the Barbadoes sort; but by the presence of impurities, chiefly we suspect of a resinous nature, the aloine is probably so entangled that it cannot get freedom for that arrangement which seems necessary for ready crystallisation. That a crystalline body may be present, and yet may not crystallise, will, we believe, be readily admitted by any one much occupied with the process of crystallisation. Another cause may perhaps be found in changes and decomposition, originating in faulty processes of preparation, the result of ignorance, carelessness or fraud. That faulty methods of preparing the aloes may be one cause of certain kinds of the drug not yielding aloine, is rendered probable by the following circumstance which came under our observation. If aloine be crystallised, either from water or rectified spirit, and the crystals left in contact with the mother-liquid, in the course of a few weeks, but more quickly in the latter than in the former case, the crystals will have then entirely disappeared, thus showing the readiness with which the aloine loses its crystallisable character. Keeping these considerations in view, and taking advantage of what little we now know of the properties of the aloine the following steps were taken :—

The watery solution of Cape aloes having been mixed with a very little sulphuric acid, to separate a quantity of coloring matter along with a fatty acid and chlorophylle, was filtered, and then evaporated *in vacuo* to a thin extract. The extract was shaken with a quantity of ether, which was then poured off, and allowed to evaporate very slowly. Aloine at length crystallised, but of course, from its slight solubility in ether, the quantity was very small; but the thick liquid, which had been washed with the ether, after standing undisturbed for a week or two, was found to have yielded a crystalline crop of aloine considerably more abundant.

The nature of the process by which the presence of aloine in the Socotrine aloes was tested by us was somewhat different from the preceding. A strong alcoholic tincture of the aloes having been prepared, sulphuric ether was added as long as any precipitate was produced. A dark-colored compound of lime being thus taken out of the way, the ethero-spirituous solution, after becoming quite clear, was mixed with a small quantity of water. The result was a separation of the mixed liquids into two distinct portions; the one heavier, composed of most of the water and spirit and a little ether, forming the under portion; and the lighter, consisting principally of ether, but containing a little spirit and water, floating above it. The heavy liquid having been separated, was exposed to a heat of about 130° F. till the spirit and ether had completely evaporated. The watery solution now left, on cooling gave crystals having the characteristic appearance of aloine, and a trial strengthened this belief of their nature. The lighter liquid, on slow evaporation, likewise produced similar crystals.

The solutions of aloine are wonderfully altered by the action of the air. One striking experiment made by us will perhaps place this character of aloine in as strong a light as any that could be stated. 2 grs. of aloine having been dissolved in 2 oz. of distilled water, the solution, which was of a very pale yellow color, was corked up in a phial that was nearly filled with it, and then set aside in a heat of about 120° F. The color of the solution gradually passed into a fine red, deepening continually in intensity, till in a few weeks the color had become so deep as almost entirely to obstruct the passage of light.

It may not also be without some interest to mention here, the singularly striking effect of nitric acid upon the aloine. ½ a drm. of strong commercial nitric acid being put into a test-tube, and 15 grs. of aloine gradually added, great heat and violent action are produced, with the escape of red fumes, and a perfect solution is the result. The syrupy liquid being now added to cold water, a yellow precipitate is formed, which however dissolves on adding more water; and on neutralising the liquid with aqua potassæ, a liquid of a splendid red color is produced. The intensity of the color is so great, that on comparing it with a liquid of equal bulk, and containing the coloring matter of 2 oz. of cochineal, that colored by the aloine is of a deeper red, and even in

* Since writing the above, a vessel containing a solution from the Cape aloes, and which had been put aside and remained undisturbed for a long period, has been examined, and found to contain a mass of crystalline matter, exactly of the same appearance as that first obtained from similar solutions of the Barbadoes aloes, which, we feel satisfied, will turn out to be aloine.

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the richness of its shade rivals the other. When the liquid is slowly evaporated, tufts of long needle-shaped crystals of chrysammate of potassa are produced.

For an account of the chemical characters of aloine, we beg to refer to an article by our friend Dr. Stenhouse, in the *London, Edinburgh and Dublin Philosophical Magazine* for December last, from a consideration of which it will be quite obvious that the substance we have obtained from the aloes is quite different from that described by Mr. Edmund Robiquet.

ANALYSIS OF TWO SAMPLES OF SOUTH AUSTRALIAN GOLD.*

Mr. James Napier, of 198, Pitt Street, Glasgow, writes as follows to the Editors of the *Philosophical Magazine and Journal*.

"Gentlemen—The following extract from a letter I have recived may be interesting to some of your readers.

"Yours respectfully,

"James Napier.

"'The gold is found in little thin leaflets amidst cubical crystals of oxide of iron, which is partly mixed with it, so that it cannot be freed entirely by mechanical means. One sample, freed as much as possible by mechanical means of the oxide of iron, was of specific gravity 14·63, and gave by analysis—

	I.	II.
Gold	87·78	87·77
Silver	6·07	6·54
Peroxide of iron by loss	6·15	5·69
	100·00	100·00

"'The alloy obtained was of specific gravity 18·83, and gave by analysis—

	I.	II.
Gold	93·53	93·06
Silver	6·47	6·94
	100·00	100·00

"'Another sample of the alloy submitted to analysis, gave—

Gold	96·42
Silver	3·58

"'Andrew D. Thomas.

"'Patent Copper Works, Burra Burra, June, 1850.'"

ON A PROCESS FOR ESTIMATING THE AMOUNT OF PRUSSIC ACID IN MEDICINAL PRUSSIC ACID AND BITTER ALMOND AND CHERRY-LAUREL WATERS.*

BY PROFESSOR LIEBIG.

When a solution of caustic potassa is added to a liquid containing prussic acid, until a strong alkaline reaction is manifested, and a dilute solution of nitrate of silver slowly poured into it, a precipitate is formed, which, on agitation, immediately disappears to a certain limit. When the prussic acid is mixed with a solution of caustic potassa and a few drops of chloride of sodium, and then the solution of silver added, a certain proportion of the latter may be added as in the previous case before a permanent precipitate forms, which in this case is white chloride of silver.

The liquid containing prussic acid, when mixed with potassa, contains cyanide of potassium, in which the oxide and chloride of silver are soluble, until the well-known double compound, consisting of equal equivalents of cyanide of potassium and cyanide of silver, is formed, and which is not decomposed by an excess of potassa. When therefore the amount of silver in the solution is known, and at the same time how much of it in volume or weight has been added to the alkaline liquid containing the prussic acid until the formation of a precipitate, we can thence determine the amount of cyanogen or prussic acid in the liquid, for 1 equivalent of consumed silver exactly corresponds to 2 equivalents of prussic acid.

The following experiments by Dr. Fleitmann will show the accuracy of the method. In the first place, the amount of prussic acid in a very dilute solution was determined directly by precipitation with nitrate of silver; 100 cub. centim. of this prussic acid furnished 0·332 grm. cyanide of silver, corresponding to 0·067 per cent of acid. The same solution required for the complete precipitation of a normal liquid containing in 100 cub. centim. ½ a grm. of metallic silver, 53·5 cub. centim. 100 cub. centim. of the same prussic acid, mixed with potassa, and then constantly shaken with the same solution of silver until the appearance of a milkiness, required 27 cub. centim. 150 cub. centim. of the same prussic acid required 40 cub. centim. of the silver solution; according to these experiments the liquid contained—

* Liebig's *Annalen*, January, 1851.

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	By direct determination.	By a measured quantity of normal liquid in alkaline solution. I.	II.	acid solution.
Prussic acid.....	0·067 p. c.	0·068	0·067	0·067

Similar results were obtained by M. Fabre.

It follows from these experiments, that the method of determining the amount of prussic acid in an alkaline liquid by means of a normal solution of silver is as trustworthy and accurate as any of the best methods hitherto employed; whilst in several other respects, for instance the ease and quickness with which the experiment is made, it far surpasses them.

The presence of formic acid or hydrochloric acid in the prussic acid, which would render the determination of its amount by a normal solution of silver inaccurate, has not the slightest influence on its estimation in the alkaline liquid; and it has moreover the advantage, that as soon as the reaction becomes perceptible, the operation is terminated, in which it is preferable to similar methods the completion of which depends on the cessation of the reaction. In the estimation in the alkaline liquid, both liquids that are mixed remain clear: as soon as the slightest permanent milkiness is perceptible, the analysis is finished, and to arrive at this point one or two minutes suffice. In ascertaining the quantity directly by nitrate of silver, a precipitate is formed, which renders the liquid turbid; towards the end of the operation it is necessary to wait until this has subsided and the liquid again become clear, in order to determine when no further precipitation occurs. Now with the dilute liquid the last traces of cyanide of silver settle with much greater difficulty than in the estimation of chlorine; and it is precisely owing to this circumstance that the method is disagreeable and tedious.

Aqueous prussic acid is so rarely employed for medicinal purposes, that a test for that is scarcely required; but the distilled waters of bitter almonds, and of cherry-laurel, both of which contain prussic acid, are in daily use; and it is highly desirable that the amount of the active ingredient should, under certain circumstances, be ascertained with accuracy; the process described answers admirably for the purpose.

In general, cherry-laurel water is clear and transparent; the water of bitter almonds, on the contrary, is usually milky from the presence of little drops of oil; and it is requisite to mix the latter with 3 to 4 times its bulk of water to render it clear, otherwise the termination of the reaction is not seen distinctly.

The method described may also serve to test the commercial cyanide of potassium; and by its means I have unexpectedly found that the cyanide prepared by the method described by me contains a comparatively small amount of cyanide of potassium. Two samples from two different preparations were examined; the one furnished 63·5 per cent., the other only 59·99 per cent. of cyanide of potassium.

POLARISATION BY CAOUTCHOUC AND GUTTA PERCHA.*

BY PROF. CHAS. G. PAGE, M.D.

GUTTA percha, when rolled into thin sheets or drawn into ropes, comports itself like a fibrous substance, which is not the case with caoutchouc. A strip cut from a thin sheet of gutta percha may be stretched considerably in one direction, that is in a line with the fibre, but any attempt to stretch it across this line is followed at once by a rupture. It is not so with a sheet of caoutchouc, which will stretch equally well in all directions. On examination of thin sheets of these two substances—so far believed to be *isomerical*—a marked difference of texture is at once perceived. The caoutchouc gives little or no change of color, while the gutta percha exhibits a beautiful spectacle. It appears to be built up of prisms of every variety of hue, and, as it were, fused into each other. It resembles more nearly some specimens of ice which I have examined than anything else. The caoutchouc and gutta percha must be kept under considerable tension during the examination.

There is one mode, however, in which I have produced some fine figures by means of caoutchouc. The caoutchouc is made into little balloons in the following manner:—A very thin sheet is tied over the end of a tube of one-half inch bore, and the caoutchouc blown out into a ball and firmly tied just beyond the end of the tube with a piece

* Silliman's *American Journal*, Jan. 1851.

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of silk. They can with a little practice be very conveniently made by the mouth. The caoutchouc is drawn over the open mouth, and by strong suction it is forced in, filling the mouth, when the lips and teeth are compressed over the outer portions so as to form a neck, which is at once twisted up by the fingers and secured with a string. The caoutchouc thus highly stretched, becomes almost transparent; and when viewed by polarised light, it gives, when in this constrained condition, a definite system of colors, not unlike the figures produced in a circular piece of tempered glass.

ON DECHENITE.*

BY DR. C. BERGEMANN.

This mineral was discovered by Dr. Krantz in veins of a lead ore containing galena, carbonate and phosphate of lead, at Lauterthal in Rhenish Bavaria. It occurs in kidney-shaped crystalline aggregations, or in small, thin and curved plates. It was impossible to determine its crystalline form; there are, however, indications of cleavages which appear to belong to a rhombohedron. Its color is dark red, passing sometimes into yellow; in powder it is always yellow. It is translucent, and has a fatty lustre; spec. grav. 5·81; hardness scarcely 4, equal to that of phosphate of lead. Before the blowpipe it fuses readily into a yellowish glass without decrepitation. It was found, on analysing the purest specimens, to consist solely of oxide of lead and vanadic acid in proportions corresponding to the simple formula PbO, VO^3. The complete absence of chloride of lead distinguishes it from all the compounds of vanadium and lead hitherto analysed.

The analysis was made by dissolving the mineral in dilute nitric acid, which is easily effected, separating the lead by *long* digestion with sulphuric acid and subsequent addition of alcohol. The sulphate of lead proved perfectly free from vanadic acid. The sulphuric solution of the latter constituent was evaporated to dryness and calcined; but it was found, contrary to the statement of Berzelius, that the whole of the sulphuric acid could not be expelled by heat; it was therefore separated by nitrate of baryta, and the excess of baryta removed by a little ammonia and carbonate of ammonia: the filtered liquid, evaporated and strongly calcined, left pure vanadic acid, which was weighed as such, the author finding the method of determining its weight from that of the hydrated oxide far less accurate.

* Poggendorff's *Annalen*, vol. lxxx. p. 393.

RESULTS OF EXPERIMENTS ON THE INFLUENCE OF NITROGEN ON VEGETATION.*

BY M. CH. MENE.

For some years, more especially since the interesting researches of M. Boussingault, it has been generally admitted that the nitrogen of the air is often absorbed by plants. More recently, M. Ville has published a communication made to the Academy, in which it is stated that this absorption is a daily necessary for the purposes of vegetation.

M. Mène then proceeds to give a detailed account of a long series of experiments, undertaken by him on this subject. As our limits will not allow our giving a report of these experiments, we content ourselves with citing the conclusions thence deduced by M. Mène:—

1. That plants derive from the soil and from manure all the nitrogen they require.

2. That plants do not absorb nitrogen from the air.

ON RUBIAN AND ITS PRODUCTS OF DECOMPOSITION.†

BY EDWARD SCHUNK, ESQ., F.R.S.

After pointing to the obscurity in which the inquiry concerning the state in which the coloring matter of madder originally exists in this root is involved, the author refers to the change which takes place in the root, especially if in a state of powder, during the lapse of time, and to the little light which has been thrown by chemical investigations on the nature of the process by which the change is effected. He states that it has been suspected by several chemists that there exists originally some substance in madder, which, by the action of fermentation, or oxidation, is decomposed, and gives rise by its decomposition to the various substances endowed either with a red or yellow color, which have been discovered during the chemical investigations of this root. In his papers on the colouring matter of madder, he has described four substances derived from madder, only one of which is a true coloring madder, but all of them capable under certain circumstances,

* Paris Academy of Sciences.

† Read before the Royal Society, Feb. 13, 1851.

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as for instance in combination with alkalies, of developing red or purple colours of various intensity. After referring to the opinions of M. Persoz and the investigations of Mr. Higgin* relative to xanthine and alizarine, the author observes that, by adding a variety of substances to an extract of madder with cold water, he was enabled to ascertain under what circumstances and by what means the tinctorial power of the liquid is destroyed, and consequently what is the general character of the substance or substances to which it is due. He found that by adding sulphuric or muriatic acid to the extract, and heating, the liquid, after neutralization of the acid, was no longer capable of dyeing. The tinctorial power was also destroyed by the addition of hydrate of alumina, magnesia, protoxide of tin, and various metallic oxides, but not by carbonate of lime or carbonate of lead. In all cases in which the property of dyeing in the extract was destroyed, he invariably found that its bitter taste and bright yellow color were destroyed. Having shown, in his former papers on this subject, that the intensely bitter taste of madder and its extracts is due to a peculiar substance to which he has given the name of *rubian*; and as it appeared from these preliminary experiments that this substance, though itself no colouring matter, is in some way concerned in the changes whereby a formation of coloring matter is induced in aqueous extracts of madder, he proposed to himself to examine its properties and products of decomposition more in detail than he had hitherto done.

After numerous experiments, undertaken with the view of obtaining pure rubian in quantities sufficiently large for the purposes of examination, he discovered a property of that substance, namely, the remarkable attraction manifested by it towards all substances of a porous or finely-divided nature, which is perhaps more characteristic of it than any other, and by which he was enabled to obtain it in a state of purity. The method he finally adopted, and which, he states, surpasses all others in facility and certainty of execution, is fully detailed.

Rubian, when prepared according to this method, is a hard, dry, brittle, shining, perfectly uncrystalline substance, similar to gum or dried varnish. It is not in the least deliquescent, as xanthine is described to be. In thin layers it is perfectly transparent, and of a beautiful dark yellow color; in large masses it appears dark brown. It is very soluble in water and in alcohol, more so in the former than in the latter; but insoluble in æther, which precipitates it in brown drops from its alcoholic solution. Its solutions have an intensely bitter taste. When it is pure, its solution in water gives no precipitates with the mineral or organic acids, nor with salts of the alkalies or alkaline earths. Basic acetate of lead, however, gives a copious light red precipitate in solution of pure rubian, the solution becoming colorless; but this is the only definite compound of rubian with which the author is acquainted. He states that rubian cannot be considered as a colouring matter in the ordinary sense of the word. It is decomposed by acids, alkalies, chlorine, heat, and ferments. The formula for rubian appears to be $C^{56}\ H^{34}\ O^{30}$.

The action of sulphuric and of muriatic acid on rubian is stated to be precisely the same. The products of the decomposition by those acids are—1st, *alizarine*; 2nd, the substance which he formerly termed B-*resin*, but which he now calls *verantine*; 3rd, the substance which the anthor in former papers has called *a*-resin, but to which he now prefers giving the name of *rubiretine*; 4th, a body which has not hitherto been observed, and which he denominates *rubianine*; and 5th, a sugar obtained from the acid liquid after the complete decomposition of the rubian.

1. The alizarine obtained from the decomposition of rubian exhibits all the usual properties of this well-known substance. Its color is of dark yellow, without any tinge of brown or red. The crystals possess a lustre which the author has never seen equalled in this substance. The analysis gave the formula $C^{14}\ H^{6}\ O^{4}$. By simply losing 14 equivs. of water, 1 equiv. of rubian is converted into 4 equivs. of alizarine.

2. Verantine, in most of its properties, coincides with the substance to which the author formerly gave the name of B-resin of madder. When prepared according to the method described in the paper, it is obtained in the form of a reddish-brown powder. When heated on platinum foil, it melts, and then burns away without leaving any residue. It dissolves in concentrated sulphuric acid with a brown color, and is re-precipitated by water in brown flocks. On heating the solution in concentrated sulphuric acid, it becomes black, sulphurous acid is disengaged, and the substance is decomposed. Concentrated nitric acid dissolves it on boiling, with a disengagement of nitrous acid, forming a yellow liquid, from which nothing separates on cooling. It is almost insoluble in boiling water, but readily soluble in boiling alcohol, and is again deposited on the alcohol cooling as a brown powder, which is its most characteristic property.

From an experiment described in the

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paper, the author is inclined to conclude that alizarine and verantine are capable of forming a double compound with alumina soluble in boiling water, and that a mixture of the two in the proportion in which they exist in this compound constitutes what has been called purpurine.

Although the difficulty of obtaining pure verantine in sufficient quantity for the purposes of analysis prevented the author from determining its composition with the requisite accuracy, he obtained approximations sufficiently near to remove almost all doubts on the question. The formula deduced from four experiments is $C^{14}H^{5}O^{5}$; so that it appears that verantine differs from alizarine by containing 1 equiv. more of oxygen.

3. Rubiretine is identical with the substance which the author formerly called *a*-resin of madder. He endeavored in vain to determine the atomic weight of this substance; but states that there is only one formula, which is in accordance with his analyses, and at the same time satisfactorily explains its formation. This formula is $C^{14}H^{6}O^{4}$, so that two equivs. of verantine and 2 equivs. of rubiretine with 12 equivs. of water give 1 equiv. of rubian.

4. Rubianine greatly resembles rubiacine in its appearance and many of its properties. It may however easily be distinguished by several characteristics, and above all by its composition. It is obtained from a solution in boiling alcohol in the form of bright lemon-yellow silky needles, which when dry form an interwoven mass. It is less soluble in alcohol, but more so in boiling water, than any of the preceding substances. On the solution in boiling water cooling, it crystallises out again in yellow silky needles. Its color is lighter than that of rubiacine. When heated on platinum foil, it melts to a brown liquid; then burns, leaving a carbonaceous residue, which on further heating disappears entirely. It is soluble in concentrated sulphuric acid, with a yellow color; the solution on boiling becomes black, and gives off sulphurous acid. It is not affected either by dilute or concentrated nitric acid even on boiling; it merely dissolves in them, and on the acid cooling, crystallises out again as from boiling water.

There are three formulæ, all of which give for 100 parts of this substance numbers not widely differing from those deduced from the analyses, viz., $C^{28}H^{17}O^{13}$, $C^{33}H^{19}O^{15}$, $C^{44}H^{24}O^{20}$, but the last is that with which they best agree.

5. The sugar is always obtained in the form of a transparent yellow syrup, which neither crystallises, however long its solution may be left to stand, nor becomes dry unless heated to 100° C. There are two formulæ, $C^{14}H^{14}O^{14}$ and $C^{12}H^{12}O^{12}$, both of which agree with the analyses of this substance, and explain its formation. The author states the views to which each of these formulæ gives rise, and the reasons for adopting the latter.

Although five substances are produced by the action of acids on rubian, the author does not consider that these substances are all formed together, or in other words, that 1 atom of rubian, by its decomposition, gives rise to all five at the same time; but that, from the composition of these substances as compared with that of rubian, it follows, that the decomposition affects three separate atoms of rubian. One of these atoms loses 14 atoms of water, and is converted into alizarine. The second loses 12 atoms of water, and then splits up into verantine and rubiretine. The third takes up the elements of water, and then splits up into rubianine and sugar. Whether it would be possible to confine the decomposition of rubian entirely to one of these processes, or whether all three are essential, he considers is a question of the highest importance, not so much in a theoretical as in a practical point of view; and that should any chemist succeed in changing rubian entirely into alizarine, he would be the means of giving a great stimulus to many branches of manufacture and adding largely to the national wealth.

ON CARMINE SPAR.*

BY F. SANDBERGER.

This mineral accompanies Beudantite at Horhausen; it occurs in tufts of slender needles, or in spherical masses with a radiated structure; its crystalline form could not be determined. Color carmine-red, passing into brick-red; it is highly translucent, with a vitreous lustre inclining to pearly. It is brittle, and appears to possess cleavages parallel with the faces of a rhombic prism. Hardness between calcareous spar and rock salt. Heated in a closed tube it experiences no alteration. Before the blowpipe it fuses readily upon charcoal into a gray scoria, diffusing copious arsenical fumes; with soda, globules of lead are obtained; and with borax a strong reaction of oxide of iron. It dissolves readily in hydrochloric and nitric acids.

The author was not able to obtain a quantity sufficient for a quantitative ana-

* Poggendorff's *Annalen*, vol. lxxx. p. 393.

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lysis; but his experiments appear to him to prove satisfactorily that the mineral is composed of the anhydrous arseniates of lead and iron.

ON THE ACTION OF NITRIC ACID ON VARIOUS VEGETABLES, WITH A MORE PARTICULAR EXAMINATION OF THE COMMON BROOM (SPARTIUM SCOPARIUM. LINN.).*

BY JOHN STENHOUSE, ESQ., F.R.S.

THIS is a continuation of a series of investigations intended to elucidate the nature of vegetables by means of chemical reagents. A former paper contained an account of the effects produced by the action of sulphuric and hydrochloric acids on the incrusting matter of several plants belonging to different great classes of vegetables. The effects of nitric acid upon a variety of vegetable groups are now described; the researches having been undertaken in the hope that by means of this powerful reagent some light might perhaps be thrown on peculiarities in their respective constitutions.

The first plant experimented on with this view, was the *Populus balsamifera*, as representing the numerous family of the Poplars. A quantity of the smaller branches of this tree, cut into pieces, was exhausted with boiling water. The dark-colored bitter-tasted liquid which it yielded was evaporated to the state of an extract, which was digested for nearly twenty-four hours with dilute nitric acid. This strongly acid solution was evaporated to dryness on the water bath, the dried residue was dissolved in a considerable quantity of hot water, and the solution after cooling was carefully filtered. The clear liquid, after concentration to a very moderate bulk, was exactly saturated with carbonate of potassa. A yellow crystalline sediment quickly appeared. It consisted of nitropicrate of potassa, and the potassa salt of a new acid, to which the author has given the name of *nitropopulic acid*. The mixed potassa salts were then collected on a filter, dried by pressure, and were treated with a cold solution of dilute carbonate of potassa, which readily dissolved out the nitropopulate of potassa, while it left the nitropicrate of that base unacted on. The two salts were then separated by filtration, the nitropicrate remaining on the filter, while the nitropopulate was dissolved in the alkaline liquid. The solution was next slightly supersaturated with hydrochloric acid, when the nitropopulate of potassa precipitated as a compact crystalline powder, which was purified by repeated crystallisations out of hot water. When pure, the potassa salt, which crystallises in small lemon-yellow prisms, is boiled with a considerable excess of hydrochloric acid, and, on the cooling of the solution, the nitropopulic acid is deposited in silky needles, forming concentric groups of a pale yellow color. By digestion with animal charcoal, the nitropopulic acid is rendered perfectly colorless. It is very soluble in water, and still more so in weak and strong spirits of wine. By digestion with strong nitric acid, it is rapidly converted into nitropicric acid. In several of its characters nitropopulic acid bears a considerable resemblance to indigotic acid. When subjected to analysis, the formula of nitropopulic acid dried in the air was found to be $C^{14}H^3N^2O^{13}+HO+2Aqu$; that of the acid dried at 212° F., $C^{14}H^3N^2O^{13}+HO$.

The potassa, silver, soda and baryta salts were also analysed.

The *Populus nigra*, when treated with nitric acid, was also found to yield nitropopulic acid, which appears therefore to be characteristic of the poplar tribe.

An extract was also prepared from *Salix russelliana*, or the Bedford-willow, which, when it was digested with dilute nitric acid, yielded a great deal of oxalic and nitropicric, but no nitropopulic acid. Extracts of the *Cytisus laburnum*, or the laburnum-tree; of the *Swetenia mahogani*, or the mahogany-tree; of the *Pyrus malus*, or the apple-tree; of the *Crotægus oxyacantha*, or the hawthorn; of the *Ribes nigrum*, or the black-currant bush; of the *Betula alnus*, or the alder; of the *Ulex europæus*, or the furze; of the *Calluna vulgaris*, or common heather; of the root of the *Curcuma longa*, or turmeric; of the seeds of the *Bixa orellana*, or annotto; of the *Sambucus nigra*, or the elder; of the *Cytisus scoparius*, the *Spartium scoparium* of Linn., or common broom, when treated with dilute nitric acid, also yielded oxalic and nitropicric acids. The extracts of *Quercus robur*, or common oak, and of *Betula alba*, the birch-tree, when digested with nitric acid, only yielded oxalic acid, but no nitropicric or any analogous nitrogenated acid.

The results of these experiments seem to indicate therefore that a far greater number of plants are capable of yielding nitropicric acid than has generally been supposed, those which fail to do so constituting a very small minority.

As the extract of broom, *Spartium sco-*

* Read before the Royal Society, Dec. 12, 1850.

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parium, besides yielding nitropicric acid, exhibited some interesting peculiarities, it was subjected to more minute examination. When an aqueous decoction of broom was concentrated to about a tenth of its bulk, and set aside in a cool situation for twelve hours, it gelatinised into a greenish-brown coherent mass, which was thrown upon a filter and washed with a little cold water. It consisted chiefly of a yellow crystallisable coloring matter (scoparine, the diuretic principle of broom), which was at first contaminated with a considerable amount of chlorophylle. It also contained a small quantity of a volatile organic base (sparteine, the narcotic principle of broom), the greater portion of which however remained in the mother-liquors.

The scoparine, when purified by repeated crystallisations out of hot water and spirits of wine, formed pale yellow prisms of a feeble acid character. Its formula was found to be $C^{21}H^{11}O^{10}$. Scoparine acts as a powerful diuretic.

The mother-liquor from the crude scoparine, after having been concentrated to a very moderate bulk, was distilled along with a considerable excess of soda, when a colorless basic oil slowly collected at the bottom of the receiver. This oil was the volatile base sparteine. It has a strongly alkaline reaction, completely neutralising the most powerful acids. It is but slightly soluble in acids, but readily dissolves both in alcohol and in ether. It boils at about 550° F. The taste of its salts is very bitter. The formula of this base is $C^{15}H^{13}N$. The nitrate, sulphate and hydrochlorate of sparteine are exceedingly soluble, and crystallise with great difficulty. The nitropicrate of sparteine forms long, slender brittle needles, undistinguishable from nitropicrate of potassa. Its formula is $C^{15}H^{13}N$, HO, $C^{12}H^{2}N^{3}O^{12}$.

The double chloride of platinum and spartrine crystallises in rectangular prisms. This salt contains two equivalents of water, which it loses at 266° F. Its formula, when dried at 212° F., is $C^{15}H^{13}N$, $HCl+PtCl^{2}+2HO$.

The double mercurial salt crystallises in large, right rhombic prisms, exhibiting the diamond lustre. Its formula is $C^{15}H^{13}N$, HCl, HgCl.

Sparteine appears to be a strong narcotic poison, though much inferior in this respect to either nicotine or coneine.

It is plain, therefore, that in employing a decoction of broom-tops in dropsical affections, as has hitherto been the practice, the patient is subjected to the narcotic influence of the sparteine as well as to the diuretic effects of the scoparine, a result which in general is not likely to be desirable. The author does not, however, think it is at all necessary to employ chemically pure scoparine for medical purposes. If a decoction of broom be evaporated to dryness on the water-bath, then treated with a little dilute hydrochloric acid, the mixture thrown upon a filter, and washed with a small quantity of cold water, almost the whole of the sparteine will be removed, and the dark green gelatinous mass remaining on the filter will be found to possess the diuretic without the narcotic properties of the plant.

ON THE COLORING MATTERS OF THE MORUS TINCTORIA.*

BY M. R. WAGNER.

To isolate the coloring matters of the morus tinctoria, M. Wagner exhausted this matter several times with boiling water, as directed by M. Chevreul. The liquors, filtered hot, deposited on cooling a thick yellow precipitate, which was collected on a filter, and washed with a little cold water. This precipitate was a mixture of a peculiar tannic acid with a calcareous salt containing the true coloring matter of the wood, to which the author has given the name of *morine*.

MORINE.

To prepare this substance in the pure state, the filtered decoctions of morus tinctoria are evaporated, until reduced to 5 quarts for 5 kilogrammes of wood employed. The liquor is left to itself for a day or two. At the end of this time, there is formed at the bottom of the vessel a thick deposit of the yellow precipitate which we have just mentioned. The brown liquor containing this precipitate also furnishes a small quantity of it by a second evaporation. It contains essentially a peculiar tannic acid, which is likewise a coloring matter, and to which M. Wagner has given the name of morinic acid.

The yellow precipitate is collected on a filter, pressed between folds of blotting paper and dissolved in alcohol. Water added in large quantity precipitates from this solution the compound of morine with lime under the form of brownish-yellow flocks. The product obtained is purified by treating it several times with alcohol and water. After having dissolved it and precipitated it thus three or four times, it is obtained under the form of a sulphur-yellow powder, crystalline and containing 6·8 per cent. of lime. Morine is easily separated

* *Journal für Praktische Chemie.*

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from this compound by boiling it with from 15 to 20 times its weight of alcohol at 75° and with 12 per cent. of crystallised oxalic acid. The boiling filtered solution, poured into 100 times its volume of water, deposits morine under the form of a yellowish-white crystalline powder, capable of being obtained perfectly white by new solution in alcohol and precipitation by water. It is dried at 212° F. *in vacuo*.

Almost insoluble in cold water, morine dissolves in small quantity in boiling water (1 part in 100). The solution is almost colorless, and deposits the greater part of the morine on cooling. It readily dissolves in alcohol and ether: the solutions are yellow when they are concentrated; they are slightly acid. The alcoholic solution is precipitated by water, depositing the morine under the form of colorless flocks. An almost colorless solution of morine turns yellow in the air; this coloration is not due to the absorption of oxygen, but to the absorption of a small quantity of ammonia. It is therefore easy to make it disappear by adding a few drops of an acid. The ammoniacal solution of morine turns brown in the air and finally black.

It is known that M. Dupasquier proposed the use of an infusion of Campeachy wood for detecting the bicarbonate of lime in spring water, and that M. Erdmann employed hœmatoxyline as the most delicate test for ammonia. An alcoholic solution of morine may be substituted for these reagents. Whilst distilled water or slightly-gypseous spring water are not colored when a few drops of an alkaline solution of morine are added to them, water containing a trace of alkaline carbonate is immediately colored of a deep yellow. This reaction is so delicate that paper steeped in an alcoholic solution of morine, and completely colorless, becomes yellow when exposed to the smoke of tobacco.

Heated to 356° F., morine disengages water without undergoing other alterations; it resists a temperature of 482° F.

At 572° F., it turns black, disengaging a great quantity of carbonic acid. At the same time, there passes into the receiver a small quantity of a yellow oil which concretes in crystalline grains, and a very considerable quantity of spirole is formed. Concentrated sulphuric acid dissolves morine, and water precipitates it from this solution.

Concentrated nitric acid dissolves and decomposes it; in evaporating the solution, nitrous vapors are disengaged, and the liquor deposits by cooling large tables of a yellowish-white. These crystals are the oxypicric acid of M. Erdmann. Heated on a platinum plate, they fuse and burn rapidly. The salt which they form with potassa detonates violently. With baryta and sulphate of protoxide of iron, they form a colorless liquor.

The alkalis and the alkaline carbonates dissolve morine, forming a yellow liquor which becomes colorless when neutralised with an acid.

The sesquichloride of iron gives a blood-red coloration; with the aqueous solution of morine, as M. Chevreul has already observed, the smallest quantity of morinic acid mixed with the morine is recognised by a blackish-green coloration.

Protosulphate of iron forms an olive-green precipitate. Sulphate and acetate of copper are reduced by morine when an alkali is at the same time added.

The ammonio-nitrate of silver is immediately reduced.

According to the analyses of the author, the composition of morine is expressed by the formula

$$C^{18}H^{8}O^{10}.$$

MORINIC ACID (MORI-TANNIC ACID).

Morinic acid is found in the liquor from which the compound of morine with lime has been precipitated. It is, however, easier to extract it from blocks of wood of the mulberry tree, the central part of which contains very considerable deposits of this substance. These deposits form layers of a dirty-yellow substance, sometimes of a flesh-red. The fracture of these pieces is sometimes half an inch thick, red-brown and crystalline: they dissolve almost entirely in alcohol, ether and boiling water. By the cooling of the aqueous solution, great part of the morinic acid is separated, and may be purified by several crystallisations. In order to separate a red resinous matter which accompanies the crystals, it is finally dissolved in a large quantity of boiling water acidulated with hydrochloric acid, and the liquor filtered until it is no longer turbid. By afterwards leaving it to itself, the morinic acid is deposited under the form of a pale yellow crystalline powder.

The taste of this acid is sweetish and astringent; it is sparingly soluble in cold water, and dissolves easily in boiling water. The solutions are yellow and possess an evident acid reaction. It likewise dissolves in alcohol, ether and pyroxylic spirit.

Concentrated sulphuric acid dissolves morinic acid without the aid of heat, and water precipitates it from its solution. When this solution, prepared without heat, is left to itself for several days, a brick-red body is separated, which, by the action of small quantities of ammonia, acquires a magnificent purple color.

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Morinic acid precipitates tartar emetic of a brown-yellow, and sulphate of iron blackish-green. It reduces, by boiling, the ammonio-nitrate of silver and acetate of copper. Chloride of gold is also reduced, without heat. Sulphate of quinine is precipitated of a pale yellow.

With the neutral acetate of lead, it forms a chrome-yellow precipitate which dissolves in boiling water, and which forms on cooling crystals of a citron-yellow.

Its composition is represented, according to M. Wagner, by the formula $C^{18}H^{8}O^{10}$. He regards it as a tribasic acid, which may be placed between the tannic acid of catechu, $C^{16}H^{8}O^{8}$, and the tannic acid of nut-galls, $C^{18}H^{8}O^{12}$.

ON THE EXTRACTION OF OXYGEN FROM ATMOSPHERIC AIR.*

BY M. BOUSSINGAULT.

I BEG permission of the Academy to lay before it the results of an investigation with which I have been long occupied.

I proposed to myself this problem: to extract, in the pure state and in considerable quantity, the oxygen mixed with nitrogen in atmospheric air.

It is very singular that no attempt has yet been made to extract this gas from the atmosphere of which it constitutes a fifth part, and the first time, perhaps the only time, we have seen a substance take and concrete oxygen, to restore it afterwards pure and in the gaseous state, was in the memorable experiment by which Lavoisier separated the elements of the atmosphere by heating a mercury bath in a very limited volume of air; it was also necessary to maintain the metal for twelve days near the boiling-point, in order to obtain rare particles of red precipitate from which were extracted, by calcination in close vessels, a few cubic centimetres of oxygen. It is evident that this process is not practicable, not only on account of the smallness of the product, but also of the necessity which exists of disengaging oxygen in an apparatus other than that in which the metal is oxidised, an inadmissible condition in the programme I had traced out for myself.

Among the very few bodies of which I could avail myself for endeavoring to solve the question, as it was put, I gave the preference to baryta, relying on its well-known property of fixing the oxygen at a low temperature and of abandoning it under the influence of a sufficient degree of heat.

It is known that if a current of hydrogen be passed over pieces of baryta placed in a tube heated to dull redness, the gas is completely absorbed: so completely, indeed, that its appearance at the other end of the tube takes place only when the baryta is entirely superoxidised. This is the process invented by our illustrious colleague, M. Thenard, for preparing the binoxide of barium. If, when the binoxide is formed, the temperature be raised to above cherry red, it is almost instantaneously decomposed, and when we operate on a kilogramme of matter, 73 quarts of oxygen gas may be collected. After the rapid decomposition of the binoxide, the baryta resumes its aspect and original properties, and it may be again oxidised, the oxygen disengaged, and so on *ad infinitum*.

It is this property which baryta possesses of being oxidised and deoxidised under the influence of the air, within very narrow limits of temperature, which I turned to account for isolating at first, and afterwards collecting, the oxygen of the atmosphere, after having proved that the baryta may be peroxidised by a current of dry air, deprived of carbonic acid.

The apparatus I made use of consists of a porcelain or glazed stone-ware tube, passing through a furnace with a dome. The baryta was introduced in pieces into this tube, at the anterior extremity of which was fixed a stop-cock, by means of which the access of air might be permitted or interrupted.

To the outgoing orifice of the tube was adapted a branch, to which two other stop-cocks were adjusted; one communicating with an aspirator, the other with a gasometer.

The flowing of the water contained in the aspirator determined the arrival of air in the tube, the temperature of which was maintained at dull redness. Oxidation of the baryta took place. After a certain time, when this oxidation is considered sufficiently advanced, for it is not indispensable that it should be complete, the introductory stop-cock and the stop-cock of the aspirator were closed, and communication between the tube and the gasometer established. The temperature was raised: for that purpose it is sufficient to open the ashpit of the furnace; and the oxygen which had been retained by the baryta very soon passes into the gasometer.

The disengagement terminated, and it is very prompt, the gasometer is closed, the fire moderated, and, making the aspirator act, we oxidise *de novo*, and afterwards deoxidise; the two operations thus succeed

* *Comptes Rendus*, No. 8, 25 Feb., 1851.

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one another in a continuous manner. It is evident that at a dull red heat baryta performs, in some measure, the office of a filter which retains the oxygen of the air, allowing the nitrogen to escape.

The apparatus, the principal arrangements of which I have just pointed out, was worked in my laboratory, at the Conservatoire des Arts et Métiers, during the month of May, 1849, and I postponed its publication only on account of a serious difficulty which arose, and the cause of which I discovered only after much investigation.

When the baryta was used for the first time, the experiment succeeded in the most satisfactory manner; but after a few operations, often even after the second oxidation, it happened that, with the same volume of air traversing the tube with the same speed, the quantity of oxygen fixed in the baryta very rapidly diminished. We may judge of the rapidity of this diminution by numbers which I take at random from my book. These numbers refer to 250 grammes of baryta. I extracted :—

		litres.		
After first oxidation		15·5 of oxygen at 57 to 64° F. and 760mil. bar.		
second	„	11·8	„	„
third	„	8·5	„	„
fourth	„	5·9	„	„

In another experiment, in which the oxidation of baryta was not pushed so far, we had :— litres.

After first oxidation		11·7 of oxygen, temperature 57 to 66° F., 750mil. barom.		
second	„	11·7	„	„
third	„	11·7	„	„
fourth	„	10·5	„	„
fifth	„	8·6	„	„
sixth	„	6·8	„	„
seventh	„	3·8	„	„

In presence of such persistent results, for the experiments were continued for more than two months, and after having ascertained that they could not be attributed to the imperfection of the apparatus, which was fitted with extreme care, and with the most unremitting attention on the part of my assistant, it must be suspected that the air, on account of the speed with which it traversed the purifying system, did not abandon the whole of the water and the carbonic acid, and that small traces of these substances, in combining with the baryta, diminish its capacity for retaining the oxygen. However, witnessing tubes attest, by the invariability of their weight, that the air introduced contained neither moisture nor carbonic acid.

It was then thought that there were in the air certain principles which the dessiccants did not remove from it, but this opinion could not be sustained, when it was proved, by repeated experiments, that the diminution of the absorbing power of baryta was likewise manifested even when that base was oxidised by pure oxygen, and alternately oxidised and deoxidised, and also when the oxidation was operated in a very small and confined volume of air, in which it was impossible to conceive that an appreciable quantity of any foreign matter could exist. The experiments in oxygen and confined air were made on a few grammes of baryta placed in a platinum boat, which was introduced into a porcelain tube; the gasometer was replaced by one or two bell-glasses placed over mercury, and whose capacity was divided into cubic centimetres.

(To be concluded in our next.)

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

MEMOIR ON THE CAKES OF OLEAGINOUS SEEDS.*

BY MM. E. SOUBEIRAN AND J. GIRARDIN.

THE grounds or cakes of oil are eminently useful in rural economy, in two ways. In powder, or mixed with urine, they constitute a very active manure, and they restore directly to the earth a fecundity always readily exhaustible. They form, on the other hand, an excellent food for cattle, and they aid very efficiently in fattening them.

The value of these cakes is proved by the considerable quantity of them exported into England. From 1836 to 1840, France exported to England 120,000,000 kilogrammes, and from 1840 to 1847 these exportations amounted to 264,361,000 kilogrammes. It is in Marseilles, Dunkerque

* *Journal de Pharmacie*, Feb., 1851.

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and in almost all our Norman ports that the English, who seek to produce as much meat as possible, provide themselves with these residues of the manufacture of oil.

Hitherto these cakes have not been analyzed in a perfect manner. MM. Boussingault and Payen* determined only the proportion of nitrogen which they contain, and it was on this proportion alone that they fixed the equivalent of each of them.

But if it is true, as these eminent chemists first established a formula to show, that *manures are so much the more valuable as the proportion of nitrogenous organic substance is greater*, it cannot now be denied that certain other elements which are contained in them, often in considerable quantity, such, among others, as mineral salts, contribute greatly to the fertilising action which they exert. Practical experience, less absolute than theory, has shown this, and it appears to us established that, to estimate the comparative value of a manure, account must be taken at once of the quantity of humus or matter proper for forming it, of the nature and quantity of the salts, and in the third place of the proportion of nitrogenous matter.

It is under the influence of these ideas that we have thought proper to undertake the comparative examination of the oil-cakes of commerce; the following is a succinct detail of our experiments and their results.

1. The first operation was with the object of determining the quantity of water which they ordinarily contain in the state of dryness in which they are sold.

For this purpose, 2 grammes of different cakes, reduced to fine powder, were dried in a current of dry carbonic acid at the temperature of 212° F. We avoided the contact of the air, because the oil still contained in the powder might have absorbed a certain quantity of oxygen which would have vitiated the results.

The following is the weight of water in 100 parts of different kinds of oil-cake:—

Sessamum-cake	14·5
Beech ,, ...	14·0
Hemp ,, ...	13·8
Colza ,, ...	13·2
Pistachio ,, ...	12·0
Linseed ,, ...	11·0
Poppy ,, ...	11·0
Camelina ,, ...	11·0

2. To determine the quantity of oil which had escaped pressure, the cakes reduced to fine powder were exhausted by hydratic ether. The operation was made on 2 grammes of powder. The latter, after the exhaustion, was dried at 212° F.; the loss represented the water and oil, whence it was easy to deduce the real proportion of fatty bodies.

The following are the results:—

	Oil per cent.
Poppy-cake	14·2
Colza ,, ...	14·1
Sessamum	13·0
Camelina ,, ...	12·2
Linseed ,, ...	12·0
Pistachio ,, ...	12·0
Hemp ,, ...	6·3
Beech ,, ...	4·0

3. The proportion of nitrogen was determined by treating each time 1 gramme of oil-cake powdered, but not dried, by a mixture of lime and soda, according to Warrentrapp and Wills' method. The acid ammoniacal liquor was afterwards tested by saccharate of lime, according to M. Peligot's method.

These analyses gave the following numbers for the proportion of nitrogen:—

	per cent.
Poppy-cake	7·00
Hemp ,, ...	6·20
Pistachio ,, ...	6·07
Linseed ,, ...	6·00
Sessamum	5·57
Camelina ,, ...	5·57
Colza ,, ...	5·55
Beech ,, ...	4·50

MM. Boussingault and Payen found in the pistachio 8·33 per cent. of nitrogen: that is much more than we found; but it is to be remarked that these chemists made their analyses on seed deprived of its cortical envelope, which has none of the properties of the seed, and which constitutes at least one-third of the ordinary cake of the manufactories. Thus they estimated the value of this cake too high.

Beech cake was found to contain least nitrogen in our experiments and those of MM. Boussingault and Payen.

4. To determine the proportion of ash, we burned 1 gramme of each cake in a porcelain crucible, in a cupel furnace. We obtained the following numbers:—

	Ash per cent.
Poppy-cake	12·5
Hemp ,, ...	10·5
Sessamum ,, ...	9·5
Camelina ,, ...	8·2
Linseed ,, ...	7·0
Colza ,, ...	6·5
Beech ,, ...	6·2
Pistachio ,, ...	5·0

* Memoir on Manures and their Comparative Values.—*Annales de Chimie et de Physique*, and *The Chemist*, first series.

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The ashes of the pistachio, and especially those of beech and sessamum, have a very alkaline reaction; the others have a similar, but weaker, reaction.

There are sulphates in all except in hemp-cake.

In all, the reagents indicate the presence of chlorine, phosphates, and calcareous salts. The latter abound in the ashes of the beech and poppy; the ash of the pistachio alone showed no traces of them.

The relations between the soluble and the insoluble parts of these ashes were found to be as follows, in 100 parts of these ashes:—

	Soluble salts.	Insoluble salts.
Camelina-cake	1·2	98·8
Colza ,, ...	2·0	98·0
Poppy ,, ...	5·0	95·0
Pistachio ,, ...	5·5	94·5
Hemp ,, ...	5·5	94·5
Sessamum ,, ...	6·0	94·0
Beech ,, ...	7·0	93·0
Linseed ,, ...10·0		90·0

5. The determination of the proportion of the phosphates contained in the ashes presented more difficulties. The search for these salts is simplified by the circumstance that the alumina contained in these ashes is not dissolved by digestion in hydrochloric acid. We assured ourselves of this in the following manner.

The solution of the ashes in hydrochloric acid was filtered and diluted with water, and precipitated by a great excess of caustic potassa. To the filtered liquor was added a solution of silicate of potassa, and it was boiled. It did not manifest the least turbidness, which would have been evident if the primitive solution had contained alumina.

This first point being settled, we determined the proportion of the phosphates in the ashes by means of Raewski's process; not that it gives phosphoric acid with great accuracy; but of all known processes it is the most simple, the easiest and the surest. However, it always indicates rather too small a proportion of phosphoric acid.

The ashes having been treated with hydrochloric acid with the aid of heat, and the liquor having been diluted with water, and filtered, it was supersaturated with ammonia; the deposit was afterwards redissolved by a great excess of acetic acid. A solution made with equal parts of acetate of soda and iron-alum was then added to it. The phosphate of iron produced was collected on a filter, washed and redissolved on the same filter by hot dilute hydrochloric acid. The iron of the solution was reduced to the state of protoxide by means of zinc free from iron, then the operation was finished by determining the quantity of a manganate of potassa of known strength necessary for decoloring it.

The following are the proportions of phosphate found in 100 parts of ash, and regarded as bone phosphate:—

	Bone phosphate in 100 of ash.
Poppy-cake	70
Linseed ,, ...	68
Hemp ,, ...	68
Colza ,, ...	66
Camelina ,, ...	50
Sessamum ,, ...	33
Beech ,, ...	33
Pistachio ,, ...	24

6. We have collected the different results of our analyses into the following table.

MATTERS CONTAINED IN 1000 PARTS OF OIL-CAKE.

	Pistachio.	Camelina.	Hemp.	Colza.	Beech.	Linseed.	Poppy.	Sessm.
Water	120	145	138	132	140	110	110	110
Oil	120	122	63	141	40	120	142	150
Organic matters	710	651	694	662	758	700	623	665
Ashes or mineral salts.....	50	82	105	65	62	70	125	95
	1000	1000	1000	1000	1000	1000	1000	1000
In the organic matters of the cakes there was:—								
Nitrogen.....	60·7	55·70	62·00	55·5	45·00	60·0	70·0	55·7
In the ashes there were: Soluble salts	2·7	0·98	5·77	1·3	1·24	7·0	6·2	5·7
In the ashes there were: Phosphate reckoned as bone phospht.	12·0	42·00	71·00	65·0	21·00	49 0	63·0	32·0

These different numbers should be, in practice, regarded as approximations, for it is very certain that each cake submitted to analysis will present differences, according to its origin and the manner in which it may have been pressed. All the foregoing analyses relate to cakes bought in the markets of Rouen, Lille and Marseilles.

We have had an opportunity of examining a beech-cake from the department of

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the Oise; it left only 4·5 per cent. of ash instead of 6·2. The color of this ash was darker, and the cake contained only 17 per 1000 of phosphate instead of 21.

All the other elements must likewise vary.

However, if it be desired to resort to analysis in any particular case, it is not necessary to make so detailed a research. The two essential constituents in oil-cake are the nitrogen and the phosphates, and the analysis may be limited to determining the proportion of these alone.

DEDUCTIONS AND APPLICATIONS.

7. As is evident from the foregoing analyses, the various cakes of commerce are far from being equally rich in active principles, and they do not contain nitrogen and the phosphates in the same proportions. Indeed, the following is the consecutive order in which they may be placed, having regard to their richness:—

	Nitrogen per cent.		Phosphates per cent.
Poppy-cake....	7.00	Hemp-cake ..	7·10
Hemp ,, ..	6·20	Colza ,, ..	6·50
Pistachio ,, ..	6·07	Poppy ,, ..	6·30
Linseed ,, ..	6·09	Linseed ,, ..	4·90
Sessamum,, ..	5·57	Camelina ,, ..	4·20
Camelina ,, ..	5·57	Sessamum,, ..	3·20
Colza ,, ..	5·55	Beech ,, ..	2·10
Beech ,, ..	4·50	Pistachio ,, ..	1·20

8. When cakes are compared with each other with regard to their richness in phosphates, we divide them into two groups. Some are very rich in these salts, since the proportion varies from 4·20 to 7·10 per cent.; these are camelina, linseed, poppy, colza and hemp. The others contain very little—from 1·20 to 3·20; these are pistachio, beech and sessamum.

This difference finds a natural explanation in the conditions of culture habitually followed for the different oleaginous plants here treated of. The plants of the first group are generally cultivated in rich or largely-manured lands: they find, therefore, in the soil which bears them an abundance of saline substances, and especially phosphates, and they absorb them in large proportions. With the plants of the second group, it is quite otherwise. Sessamum often comes up in Egypt as a succession crop after corn or maize, on lands which receive no other manure than is furnished by the inundations of the Nile. The beech, which yields the beech nuts, is a tree of argilo-calcareous soils. Finally, the pistachio, in the New World as in Senegal, is cultivated in light, sandy soils, to which phosphatic animal manures are rarely applied.

(To be continued.)

RESEARCHES ON VEGETATION.*

BY MM. CLOEZ AND GRATIOLET.

ALTHOUGH we have been occupied in researches on vegetation for upwards of three years, we refrained from publishing our results, until they should have attained the greatest degree of accuracy and extent of which they were susceptible. The late publication of M. Ville compels us, however, to make them known, and to state that we have been endeavouring to solve the same question as this gentleman, although by a different method. Our experiments were made in M. Chevreul,s laboratory, in the Museum of Natural History, and under his auspices. Our principal conclusions have been laid before M. Decaisne, and have been, to a certain extent, already made public, as they were incorporated by M. Frémy in the lectures given by him at the Museum last spring.

We do not intend to state in this place the details of our experiments; they will be explained at length in a work which we are preparing for the press: we merely lay before the Academy such of our results as seem to us to be certain and correct.

It has long been known that the green part of plants decomposes carbonic acid gas, and separates the oxygen from it. This process is performed with great rapidity, by submerged aquatic plants, and they separate more oxygen in a given time than most other plants. This fact induced us to select for our experiments different species of *Ptemageton*, *Ceratophyllum*, *Myriophyllum*, and *Conferva*.

Our conclusions may be stated thus:

I. INFLUENCE OF LIGHT.

Oxygen is disengaged rapidly in solar light, insensibly in diffused light, and not at all in darkness. In the latter case, no carbonic acid whatever is given off by plants; the contrary is generally supposed.

We endeavored to discover the comparative influence of colored glass on the decomposition of carbonic acid by the green parts of plants; as well as we could ascertain, decomposition is most rapid under colorless unpolished glass; then comes yellow glass, then colorless transparent glass, then red, green, and lastly, blue glass. We satisfied ourselves that these differences were not caused by differences of temperature.

II. INFLUENCE OF TEMPERATURE.

The decomposition of carbonic acid gas by aquatic plants exposed to light in a temperature raised gradually from 39·2° F. does not commence until the temperature is

* *Comptes Rendus.*

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59° F., and is at its maximum at 86° F. The decomposition of the same gas by plants exposed to light in a temperature which is lowered from 86° F., continues when the temperature is as low as 57·2°, 55·4°, 53·6°, 51·8°, but ceases when it is as low as 50° F.

These results are in every way conformable to those arrived at by M. Chevreul, from his observations on the circulation and ascension of the sap in plants. (*Journal des Savants*, May, 1822, p. 302.)

III. INFLUENCE OF THE SURROUNDING MEDIUM.

Vegetation of submerged plants can continue for several months in Seine water aerated and renewed every day. In river water deprived of air by boiling, and containing nothing but carbonic acid in the same proportion as Seine water, and also renewed every day, decomposition is at first very active, but soon grows less so, and ceases entirely at the end of 4 or 5 days. After this time the green color of the plants is singularly reduced in intensity.

The phases of this phenomenon are very remarkable. First of all, the gas which is produced is mixed with a certain quantity of nitrogen, which diminishes little by little, so that the last portions of disengaged oxygen are nearly pure. The total quantity of nitrogen disengaged is much more considerable than the volume of the plant; and, if the plant be analysed, it will be found that, taking equal weights, it contains less nitrogen than another portion of the same plant not submitted to the experiment. These facts show that, in the vegetation of submerged plants, nitrogen is produced from the decomposition of their very elements; that a fresh supply is therefore necessary; and that nitrogen, free or combined, is an *article of food* essential to the life of an aquatic plant.

We were led by this to inquire into the influence of ammonia and its salts. We found that ammonia and its salts, dissolved in 10,000 times their weight of water, were always hurtful. The decomposition of carbonic acid diminished, and ceased at the end of a few hours. We therefore think we are justified in concluding that nitrogen dissolved in water is directly assimilated by the plants we operated upon.

IV. ON THE MOVEMENTS IN PLANTS OF THE ABSORBED OR EXHALED ELEMENTS.

It is a fact, of the truth of which any person may easily satisfy himself, that in whatever position leaves of a Potamogeton may be placed in water, carbonate of lime is constantly deposited on the upper, and never on the lower surface of the leaves (upper and lower being used in their botanical sense). This seems to show that carbonic acid is essentially absorbed by the upper surface of leaves. The oxygen, which is produced by the decomposition of carbonic acid, has a perfectly defined course. It constantly descends from the leaves towards the roots. So that if a piece of Potamogeton, having a few leaves upon it, be placed horizontally in water, the oxygen is exhaled from the section nearest the root end of the plant.

INFLUENCE OF GYPSUM ON VEGETATION.*

BY M. C. MENE.

Ever since Franklin's great experiment, gypsum or sulphate of lime has generally been considered as possessing much fertilising power, and of being of great importance in agriculture. Having paid some attention to this substance, I make known my results, in the hope that they may be found of value to the public.

1. I filled two zinc boxes with pure sulphate of lime obtained from the double decomposition of sulphate of soda and chloride of calcium; in one of these boxes I sowed some Grass seeds, in the other some Wheat. The two boxes were then placed under glass shades, in order that all external influences might be avoided: the seeds were watered every other day. At the end of a few weeks plants had come up green and healthy, as in common soil; but as they developed, their fine appearance diminished, and at the end of a fortnight they looked dried and withered.

2. In boxes similar to the first I placed a mixture of equal quantities of pure sulphate of lime, obtained as before, and clay, and sowed the same seeds as in the last experiment; the plants came up, but not nearly so well as in an unartificial soil, and they did not ripen.

3. In boxes, and under circumstances the same as before, I sowed the same seeds on dung covered over with a layer of sulphate of lime three-tenths of an inch deep. At the end of a fortnight the plants had come up and grown wonderfully; they ripened well, and were magnificent specimens.

These facts, though of considerable practical importance, would not have shown in what way sulphate of lime really acts, had it not been for the following accident:

* *Comptes Rendus.*

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Happening to have a glass of muriatic acid in my hand one day when looking at box No. 3, I accidentally spilled some of the acid on one of the boxes, and to my great surprise the lime effervesced, and on further examination I was satisfied that the sulphate had become changed into carbonate of lime. I concluded from this that the carbonate of ammonia, given off by the decomposition of the dung, being volatilised by the heat of the sun, came in contact with the sulphate of lime, when double decomposition ensued.

To ascertain how far this was true, I got some zinc pots with bottoms pierced like a sieve; in the pots I placed some dung, then some sulphate of lime, and then I sowed some Grass seed.

When the plants had appeared and become tolerably developed, I watered them abundantly for a quarter of an hour, and in the liquid which flowed from the bottom of the pots I found sulphate of ammonia, whilst on the surface of the pots there was evidently carbonate of lime. This confirmed the view I had adopted.

I then made other experiments, which do not however bear upon the last-mentioned facts. For example, I watered Grass seeds sown in manure, in pots with pierced bottoms, with water containing one of the following substances, viz., sulphuric acid, muriatic acid, nitric acid, acetic acid, sulphate of iron, sulphate of potassa, chloride of manganese, phosphate of soda, sulphate of magnesia, nitrate of soda.

With all these substances the Grass grew well, and from the bottoms of the pots I obtained salts of ammonia which are not volatile at the ordinary temperature. From all these facts I think we may conclude—

1. That gypsum has no fertilising power, and is alone useless as a manure.

2. That gypsum is only useful in agriculture when mixed with substances containing ammonia; in which case there is a double decomposition, and the ammonia is stored up for the use of the plants.

3. That for gypsum may be substituted any other salt which will fix ammonia, and render it not volatile at the ordinary temperature.

It is my intention next year to repeat these experiments on a large scale, in order to ascertain their real practical value.

IRISH PEAT CHARCOAL.*

BY JAMES CUTHILL.

I HAVE tried the following plants in a mixture of this material and earth, with the following results:—

Geraniums.—These luxuriate in a mixture of 3 oz. of pure charcoal to 1 lb. of mould. In this material they make good saleable plants in half the usual time. Cuttings strike freely, either in the pure charcoal, or in the mixture.

Cucumbers.—For these I mixed the charred peat with mould during winter, and when the plants were put into it, they grew famously, and produced a heavy crop. The peat charcoal not only yields nutriment, but it affords good drainage. Cucumber tops strike root freely in pure charred peat.

Melons.—These succeeded in a mixture of charred peat and soil equally well with the cucumbers; and if a large proportion of the soil consists of peat, I am of opinion that the flavor of the fruit will be improved, more especially in cloudy sunless seasons.

Strawberries grow admirably in charred peat mixed with soil, and in the case of pot plants they like a good handful of the pure peat placed in the bottoms of the pots. This latter has a tendency to prevent the ingress of worms, who do not appear to like its sharp edges.

Vines.—I have not yet tried the effect of charred peat upon vines; but, judging from analogous cases, I am certain that it will prove of much advantage to them, not only as a fertiliser, but also as a means of keeping the borders porous, and thereby bringing better into action the other materials of which they may be composed. Under such an arrangement, finer flavored fruit may be expected.

Potatoes.—I have found those manured with charred peat drier and more mealy than those to which farm-yard manure was applied. In the former the foliage and stalks are more compact and firm, and when taken up the tubers were found to be clean skinned. In my case no wireworm came near them. Where potatoes are pitted in long ridges, in the open ground, a layer of peat between them and the soil helps to keep them dry, and if this heap could be covered with it below the straw it would also be an advantage.

In Flower Gardens, peat charcoal will be found invaluable, inducing, as it does, quick growth; but not over luxuriant, and consequently plenty of blossoms. Under its influence the colors of the latter are also well "brought out."

For Sweetening Cesspools, and other unavoidable nuisances, peat charcoal finely pounded will be found universally useful. I say finely pounded, because the more intimately it is mixed with the material to be

* *Gardeners' Chronicle.*

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disinfected, the greater will be its power. 1 lb. of charred peat takes 1½ lb. of water to saturate it, and hence, in addition to its sweetening qualities, it possesses great value in giving night-soil mixed with urine such a consistency as to render it capable of being transferred from our large cities, where it is not wanted, to our rural districts, where it is wanted, and where it will assist our at present distressed agriculturists to farm more highly. In this way "a plague may be turned into a profit."

The experiments mentioned above were all tried last year. This season I have found that if, instead of horse-dung being turned and sweetened for a month before it is used for forcing, it is allowed about a week's laying, and then put into a four-light pit and covered over with an inch of peat charcoal, all will be well. Under this system, by the time my cucumber plants came up, all smell was removed. Again, gardeners are much annoyed in January and February by plants damping off. I dusted my Cucumber plants in the pans every morning with peat, and I did not lose six out of 600. I have, unfortunately, had to repeat the experiment, on account of my lad having overheated the flue and burned the whole of the interior of my pit. I have again about 600 plants dusted with peat, and they look as well as the first did. In filling the pots I made holes in the mould with the finger, and dropped the Cucumber plants in, in the manner in which Leeks are planted out of doors. I then filled up the hole with peat. Those treated in this way throve better than the others, and produced a dark green leaf. In short I consider charred peat in a Melon ground to be as necessary as a telegraph to a railroad. The one is incomplete without the other. The sort of charred peat that I use is the granulated kind.

[We extract the following from the *Patent Journal*; it is a defence of an invention against which some little has been said and written, and of which we gave a description, vol. i., page 70.]

PHILLIPS' PATENT FIRE ANNIHILATOR.

When Columbus, by the simple problem of the egg, rebuked the courtiers for their envious disparagement of his discoveries, he was only illustrating the familiar saying, as applicable now, as it was in those days: "It is easy enough to do anything when we know how."

Thus there is, even in our own days of progress, many a problem, the solution of which is incompatible with our advanced state of civilisation, and which our extended state of knowledge ought to render comparatively easy; and yet we cannot solve them, until some Columbus leads the way, and, discovering to us that the solution is contained in the simple application of known principles, makes us, half-disparagingly, wonder how we could have found any difficulty in the matter.

This was more especially our position with regard to fire, until Mr. Phillips, by his admirable invention, succeeded in proving to us how simply and easily we can now control that terrible element, to which we were continuing to oppose the same agent, that ages before us had done. How inefficiently that agent serves us, the awful amount of property, and even life, which is sacrificed by the ravages of fire, will bear witness to. And even this fearful sacrifice seemed to be incapable of awakening us to a sense of the utter inefficiency of water to check the progress of fire, although a consideration of the theory of combustion, which the discovery of oxygen laid before us, nearly three-quarters of a century ago, would have clearly demonstrated this to us, and led us to devise some suitable and proper means of attacking and subduing flame, which is fire's active part.

The simplest flame consists of only two parts: the inside portion consists of the matter which is burning, in a state of vapour; while the outside portion consists of the combustion of that vapour, by its combination with oxygen; or, as it were, a sheet of inflammation enveloping a body of vapour. In complex flame, however, such as always takes place where solid matter is burning, the inside is that matter either decomposed, or in a state of vapour. The next portion is that in which the carburetted hydrogen is decomposed, the hydrogen combining with the oxygen, to form the sheet of inflammation; the carbon it leaves, being suspended at a white heat, and forming the luminous portion. This can easily be seen by making the flame play upon something cold: it will then deposit its carbon.

The awful velocity with which flame progresses is caused by the rapid manner in which its enormously high temperature, by instantaneously decomposing the neighbouring parts of the combustible material upon it is praying, disposes them to combine with oxygen. The temperature of flame may be judged of when we state, that a solid or liquid is strongly illuminative at 1832°; while a gas heated even to 3632° gives but a

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feable light. The vital part of flame being, then, this outer envelope or sheet of combustion, which has no perceptible thickness, we can easily conceive how water falling upon it can have but little effect in extinguishing it; for the streams in which the water falls, having each a considerable thickness, acts upon this sheet, merely where its surface meets their external surfaces; and as these intersections are, in fact, almost geometrical curves, with neither length, breadth, nor thickness, the amount of surface acted upon by the water is hardly anything; thus full play is left for the action of the oxygen of the atmosphere.

It is, then, clearly evident, that the only manner in which flame can be extinguished, is to check the combustion, which takes place in the enveloping sheet of inflammation. This can only be effected by completely covering over every portion of that sheet of inflammation with some substance that will thoroughly cut off the supply of oxygen to it. It is obvious that the only substance which, penetrating into all the nooks and corners where flame may exist, can produce this effect, must be gas or a vapour; and that gas or vapour so used, must not only be a non-supporter of combustion, but must be incombustible, innoxious to human life, and must be rapidly formed, and given off in great abundance, at a comparatively low temperature.

It is by fulfilling these conditions that Mr. Phillips has so happily realised a *fire-annihilator*, of which, each succeeding trial only proves more fully how well it deserves its name.

By the observation of a beautiful operation of nature, Mr. Phillips was led to consider the subject: a volcanic crater had been vomited up from the depths of the sea, and continued to give forth torrents of flame. Upon these torrents of flame, the masses of water, which the workings of the eruption and the action of the waves caused to fall upon them, had no effect whatever. While reflecting upon the singularity of this occurrence, Mr. Phillips suddenly perceived a more striking one: a cloud of vapour, blown by the wind over the flames, completely extinguished them.

A thorough conviction that the usual means of opposing the progress of fire were utterly inefficient, and the ambition of conferring a vast boon on society, induced Mr. Phillips to consider the above remarkable phenomenon in conjunction with that of combustion, with a view to the production of an apparatus, which should prove an effectual agent in preventing the terrible ravages of the devouring element.

How entirely he has succeeded, it is superfluous for us now to explain: the numerous experiments which have taken place, on a very large scale, show what a thoroughly applicable and efficient apparatus he has produced. Without going into details, we may state, that it consists of a very portable machine, composed of thin sheet-metal, containing a block composed of charcoal, nitre, and gypsum, and a certain quantity of water or ice; a small bottle, containing sulphuric acid, is placed in the centre of the block, and so arranged that a blow, on a small projecting piece of metal, at the top of the apparatus, will break the bottle, and causing the acid to act upon the block, produce instantaneously a rush of vapour, consisting of the vapour of water, nitrogen, and carbonic acid. The effect produced is almost magical: in the experiment which we witnessed on Friday last, at the London Gas-works, a building composed of wood, on which quantities of tar and other inflammable matters had been placed, and which was full of shavings in the same state, was set fire to, and produced a terrific volume of flame. Two machines being applied, in less than a minute every vestige of flame had disappeared, and Mr. Phillips immediately ascended to the upper story, to show that the effects of the gases evolved were not injurious to life. The complete success of all the experiments we were spectators of last Friday, renders more thorough our conviction that no dwelling place or building of any description in which any risk of fire is run, should be without one of them. And we are perfectly convinced also, that were they in that extended use that they deserve to be, such a thing as destruction of property from fire, far less loss of life, would never be heard of. We have heard it advanced against this machine, that it is not calculated to cool large incandescent masses, such as we invariably find in a conflagration after the volatile matter has been driven off; also that in large, open, and isolated spaces, when the wind is strong, the vapours and gases emanating from the machine would be blown away too quickly to produce any effect. Now, in the first place, it is perfectly certain, that by the proper use of the machine, no such incandescent masses will ever be allowed to form; and in the second place, that even although there might be cases in which the wind would be too strong in exposed, open, and isolated places, to allow of a perfect action of the machine, yet would such cases be most rare, and would involve no risk of life; for it is quite evident, that, in the case of a

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building or vessel, of whatever description it may be, the draught caused by the combustion in the interior will always most materially assist the action of the machine, by rapidly drawing in the mass of vapors and gasses it evolves, thus aiding them to spread over every portion of the flame's extent.

In the course of the remarks with which Mr. Phillips introduced the experiments, he called attention to a simple means of making the presence of fire known, long before it becomes serious, by causing threads of gutta-percha or other easily fusible material, to traverse the various ceilings of the different portions of buildings; these threads when fused, as they would be by a very moderate heat, set free an escapement, to which is attached an alarm bell. Might not this ingenious idea be still further carried out, and the threads attached in a similar manner to the simple apparatus which sets the annihilator in operation, thus rendering it self-acting?

In conclusion, we would fain hope that there is no foundation for the hints somewhat broadly thrown out by Mr. Phillips, that certain public bodies highly interested in keeping up a wholesome degree of excitement to insurance, by no means wish the annual sacrifices caused by fire to be reduced, and therefore oppose the introduction of the machine to the very utmost.

Surely such interests cannot be allowed to weigh against human life, were it but *one* yearly, instead of *hundreds*, to say nothing of the fearful annual destruction of property. They cannot prevent the progress of truth, however; and this invention, which we cannot but characterize as one of the most important aids social progress and humanity have ever received, must sooner or later make its way into every dwelling, and take an indispensable place amongst our household goods.

THE CHEVALIER CLAUSSEN'S FLAX PROCESS.*

At the Weekly Council Meeting of the Royal Agricultural Society, on the 25th of February last, Mr. B. Browne, of Hampen, near Andoversford, Gloucestershire, favored the Council with the result of his experience in the growth of flax. He had been one of the first members of the Society to call the attention of farmers to the cultivation of flax, which he believed to be a paying crop; and having become acquainted with what had been done in Belgium and Ireland, he had for the last seven years devoted his attention to the conditions under which the growth and management of flax in this country might be carried on in the most economical and successful manner. Mr. Browne thought it would be well for the public generally, as well as for the owners, and tenant-farmers more especially, to come to no hasty conclusion on any of the new systems of flax management proposed for their adoption, however plausible such systems may on their first presentation appear to them; but in this pursuit, as in that of higher objects, "to prove all things," and only "hold fast that which is good." The separation of the seed capsules from the stalk, the woody part from the flax fibre, the flax fibre from the glutinous matter, and also the flax fibres themselves from each other, were all important practical objects, for the attainment of which various modes had been proposed, differing from each in efficiency, economy, and the circumstance of greater or less injury, or otherwise, to the flax fibre for manufacturing purposes. Mr. Browne preferred the hot-water system of steeping to any of the former modes, as it was not only the cheapest, but fell in with the regular routine of business, summer and winter, and could be carried on by the same hands. The removal of the woody part from the flax fibre, by chemical means was easy to be accomplished, and had long ago been effected by Professor Faraday; but no case, that Mr. Browne was aware of, in which the flax fibre did not suffer injury from such chemical means, and become weak and rotten. Whatever M. Claussen's plan might then be, he feared that he had yet to surmount that difficulty, by employing only such chemical agents as will effect the separation required without injuring the strength of the flax fibre or the yarn into which it is spun. To assure himself of the quality of M. Claussen's yarns, he had sent for a sample to the mill at Rochdale, where M. Claussen's processes are carried on; and this yarn, which he then exhibited to the members, along with a specimen of cloth woven from it, would be found deficient in the strength required, and inferior to that possessed by the ordinary cotton yarns. Mr. Browne remarked, that in mixing flax and cotton together, it was necessary to cut the flax fibre short, and by chemical means nearly to destroy that fibre before it is sufficiently tender to mix with cotton; and then, with the same sized yarn, there would accordingly be nearly two parts of cotton to one of flax in any cloth manufactured from the cotton, as the flax it contained would be about as

*From the Daily News Report.

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heavy again as the cotton. He therefore conceived that, as all cloth is sold by weight, the saving would not be so much an object gained by this mixed fabric. He also thought that M. Claussen's manufactured specimen should be examined in cloth, like calico or linen, not in ribbed fabrics like stockings, which afforded no test of excellence. Mr. Browne and a friend of his had succeeded in their attempts to separate the fibres of flax from each other to such a degree as to confer on the flax the character and qualities of cotton; but by all the processes they had tried, the flax fibre had become weakened and rotten. They found that No. 16 thread, one-half foreign cotton with one-half British cotton, 120 yards long, weighed 83 grains; No. 16 thread, all foreign cotton, 120 yards long, weighed 56 grains; and therefore concluded that it would take one-third more of flax-cotton mixture to make the same surface of cloth, and to make it badly, than of foreign cotton alone. The cloth woven from No. 16 thread, one-half foreign cotton and one-half British cotton, had the appearance of the cloth employed for sieves and strainers. He made these remarks in perfect sincerity, and with no other motive than that of obtaining the truth, and of wishing it to prevail: for should M. Claussen's plan, when perfected, prove to be a better one than the hot-water system he had himself adopted, he would not hesitate to lay that system aside, and try to get from M. Claussen a license for the use of his patent, and its introduction into his own establishment at Hampen.

The Chevalier Claussen presented himself before the Council, to lay before the members a statement of his process for converting flax into a substance having similar properties to cotton for manufacturing purposes, and for improvements in the bleaching of vegetable productions and of textile fabrics composed of such productions. M. Claussen having laid on the table a copy of the "Specification" at length of these patented processes, requested Dr. Ryan to explain for him to the Council the nature and bearing of the processes in question.

Dr. Ryan stated that, although flax fibre in its usual state was specifically heavier than cotton, yet, when prepared by the Chevalier Claussen's plan, it became exactly of the same gravity as American cotton. The process of preparing the straw for scutching only occupied four hours, instead of five days—the shortest period under even the patent of the late Mr. Schenck, the one now patronised by the Royal Flax Society of Ireland. M. Claussen merely employed soda and sulphuric acid, and these in such a form and in such quantities as not to injure the most delicate fabric. Thus the proportion of soda was only 1 part in 200 parts of water. The acid was added after the straw had been boiled with the soda; and the objections to the employment of such a substance would be overcome by remarking that the proportion of the acid was only 1 to 500 of water, and that the soda present in the straw neutralizes the whole of the acid, and forms a neutral salt—sulphate of soda. In the next place, Dr. Ryan explained the process of cottonising the flax, or in other words, of splitting its fibre, and converting it into a material which could scarcely be distinguished from the finest American cotton. This he considered the most useful portion of the discovery, opening, as it did, a new market to the flax grower, and enabling the manufacturer to spin it on any machinery hitherto employed for cotton, silk, or wool. Dr. Ryan then detailed the process itself, pointing out the elastic force of the carbonic acid gas liberated in the tubes of the flax fibre by the action of an acid on the carbonate of soda, or of potassa. He also stated that he came prepared to show to the Meeting practically, by experiment, the processes of splitting and of bleaching – experiments which would render the matter intelligible to everyone present.

Dr. Ryan now handed to Mr. Way, the consulting chemist to the Society, a copy of M. Claussen's specification; and in a few moments that gentleman returned to the Council-room, and remarked that he had himself just tried the experiments according to the directions of the inventor, and had perfectly succeeded in splitting and bleaching some flax fibre. It was therefore suggested to the Chairman by Dr. Ryan that, as Professor Way was a perfectly disinterested party, it would be better for him to operate before the Meeting. This Professor Way did most successfully, bleaching and splitting a quantity of flax in the course of about two minutes. The flax fibre soaked in the solution of subcarbonate of soda was no sooner immersed in the vessel containing the acidulated water, than its character became at once changed from that of a damp rigid aggregation of flax to a light expansive mass of cottony texture, increasing in size like leavening dough, or an expanding sponge. The change was no less striking when this converted mass in its turn was placed in the next vessel, which contained the hypo-chlorite of magnesia, and became at once bleached, attaining then the color, as it had just before received the texture, of cotton.

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PHOTOGRAPHY ON PAPER.*

BY M. C. LABORDE,

PROFESSOR OF NATURAL PHILOSOPHY AT PIGUELIN, NEAR NEVERS.

MANY philosophers dispense with the first bath of nitrate of silver, and simply pass the paper through a solution of iodide of potassium, previously to the application of the aceto-nitrate of silver; this simple process gives very good results, but the shades of the negative impression always appeared to me less decided than when the double process, recommended by M. Talbot, was employed. The presence of a salt of silver, in the first coating, no doubt, causes the light to act with greater intensity. With the view to combine the advantages of the two processes, I have endeavoured to introduce the silver salt into the iodide of potassium bath, and I thus obtain, by one immersion, a coating which becomes very sensitive under the action of the aceto-nitrate of silver, and which gives the light parts of a pure white, and the shades of decided tone in the negative impression. The following are the details of this preparation:

Dissolve one part of white cyanide of potassium in thirty parts of distilled water; into this solution place by degrees, as fast as it dissolves, recently precipitated iodide of silver, and having filtered the solution, add to it the iodide of potassium bath, previously formed by dissolving four parts of iodide in sixty parts of distilled water.

The paper is then to be spread on the surface of the bath, and when well saturated, removed from the bath, drained, and placed between two folds of blotting paper,—it is ready for immediate use. To prepare the iodate of silver, add gradually a solution of nitrate of silver to a solution of iodide of potassium; the precipitate, at first white, remains in suspension as long as there is an excess of iodide of potassium; when this is no longer the case, it becomes yellow, and begins to agglomerate; carefully wash the precipitate, and dissolve it as soon as possible in the white cyanide of potassium. The image is formed on the sensitive coating of the paper, immediately on its exposure in the camera obscura.

The important point is, to find a substance which can bring out the image, or which can facilitate the action of the gallic acid; in this respect, *acetate of lime*, and *nitrate of lead*, associated with gallic acid, possess remarkable properties, and bring out each in its own way, the effect of the radiations, which the gallic acid alone is unable to manifest. Two parts of acetate of lime, added to 100 parts of the ordinary solution of gallic acid, rapidly brings out the image, and produces the most intense shade. Too large a proportion of acetate of lime darkens the clear parts of the impression, but this effect may be prevented by the addition of acetic acid to the solution. The acetate of lime possesses another interesting property, viz., that of greatly augmenting the dissolving power of water for gallic acid. Some preparations on paper require a strong solution of gallic acid, in order to show the image which is formed; by progressively increasing the dose of acetate of lime, ten or twenty times more of gallic acid may be taken up by the same quantity of water. The nitrate of lead can only be associated with gallic acid when this last is dissolved in distilled water; the proportions employed must be very much less than that of acetate of lime. The image appears very promptly, and in all its details; the shades are better cast, but less decided, and almost uniform, which gives a certain softness to the negative impression, often so much sought for.

We are thus enabled to obtain strength, by means of the acetate of lime, and softness in the impressions, by the use of nitrate of lead. I have endeavoured, but without success, to combine these two advantages in the same solution; the nitrate of lead may be mixed with acetate of lime, without any apparent change. Each of these salts may be added separately to the gallic acid, but if combined, the gallic acid quickly causes a precipitate. The gallic acid, forming a body insoluble in acetate of lead, causes the formation of the latter salt by the exchange of acid and base. When the aceto-nitrate of silver contains too small a proportion of acetic acid, the light parts of the impression readily darken under the action of gallic acid; now as this proportion is continually varying, on account of the volatibility of the acetic acid, a source of error becomes continually present, giving rise to complications in the process, which often appear unaccountable.

The nitrate of zinc, which is a fixed salt, may, to some extent, be substituted for acetic acid; it increases the sensitiveness of the silver coating, and the light parts of the impression remain a considerable time under the action of the gallic acid. It even allows us to give an alkaline reaction to the iodide of potassium bath, by potassa or ammonia, which could not be done with ordinary aceto-nitrate of silver, without the light parts acquiring a dark color as soon as the image appears. The following pro-

* *Patent Journal.*

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portions have been found to answer, but these may perhaps be improved upon by experience:—Nitrate of zinc, 2 parts; nitrate of silver, 4 parts; glacial acetic acid, 2 parts at the most; water, 60 parts. The proportion of nitrate of zinc may be doubled, but in that case the quantity of acetic acid must be diminished by one half.

ELECTRO-MAGNETIC POWER.*

We learn that Professor Page, who recently obtained from Congress an appropriation of 20,000 dollars to enable him to continue his experiments in testing, in Washington City, the applicability of the electro-magnetic power to machinery, has constructed an engine by which a cylinder printing-press is driven as well as if steam was the moving power. It is thought, however, by those who have witnessed the experiments of Professor Page, that though the power which he has arranged will answer very well in cases where motive power is only wanted in small quantities and on rapid calls, it never can come in competition with steam as a propelling power, for boats, cars, &c., &c. Others look to the experiments now in progress for more satisfactory results.

At a recent lecture at Washington, Professor Page exhibited his trip-hammer, in which he raised up and suspended an immense bar of iron, weighing 50 pounds, which produced a jarring of the whole room as it fell. Heavy blows were made in rapid succession, but the motions of the bar were so easily controlled that it was laid down slowly or rapidly at pleasure.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.†

Improvements in refining gold. William Edward Newton, of Chancery-lane, civil engineer. (A communication.) Patent dated August 22, 1850.

The present improvements in the art of refining gold consist—

1. In reducing argentiferous or any other gold bullion to a granulated, or spongy, or disintegrated molecular condition by fusion therewith of zinc, or some other metal baser than silver, and the subsequent removal of the zinc by dilute sulphuric or other acid; that is, the reducing of the gold bullion to a state to allow of the removal by acids of the silver and other impurities contained therein, so as to fit it for coinage and other purposes without quartation with silver or any other intermediate process. And

2. In pulverizing by grinding or concussion gold bullion, rendered brittle by union with lead, solder, or other suitable metal, the silver and other impurities being removed by acids in this as in the preceding case, and recovered from the acid solution by any of the known chemical means.

This operation, if properly conducted, will produce fine ductile gold in a state of great purity; that is, containing from 98·5 to 99·5 per cent. of pure gold.

Factitious saltpetre, and a mode by which factitious saltpetre may be obtained for commercial purposes. Benjamin Rotch, of Lowlands, Middlesex, Esq. (A communication.) Patent dated August 22, 1850.

In the manufacture of a factitious saltpetre from nitrate of soda and crude carbonate of potassa, where the required causticity is obtained by the action of lime, the patentee takes a quantity of crude carbonate of potassa reduced to powder, lixivates it, and boils the solution in a round iron pan till it attains a density of 40° to 45° of Baumé. It is then allowed to stand for a time, when any undecomposed sulphate of potassa will precipitate, and should be removed, after which the clear liquor is to be decanted off, and allowed to cool. At the expiration of five or six days this liquor is heated to about 175° Fahr., and diluted with water to a density of 15° Baumé; a quantity of burnt lime equal to about twenty-five per cent. of the original quantity of carbonate of potassa is then added, and well stirred in till the solution becomes caustic, when, after standing for a time, to allow of the precipitation of any carbonate of lime that may be held suspended in it, the clear liquor is to be drawn off, and concentrated by heat and evaporation to 25° Baumé, when a caustic potassa suitable for the manufacture of saltpetre will be produced.

While this operation has been going on, about 800 gallons of water should have been placed in another iron pan, and 2,000lbs. of nitrate of soda dissolved therein; a second quantity of 200 gallons of water being gradually added, and the solution boiled to a density of 42° to 45° Baumé. This solution is allowed to stand for about twelve hours to settle and cool, and is then, together with the clear liquor of the previous solution, run into a crystallizing pan, where the mixture is heated to, and maintained

*(American) Farmer and Mechanic.

†Collected from *The Mechanics' Magazine.*

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for about three hours, at a temperature of from 176° to 212° Fahr., and then gradually cooled down to about 54° to 50° Fahr., when the principal portion of the nitrate of soda will have crystallized after conversion into saltpetre. The crystals are to be collected from the mother water, placed in a centrifugal drying machine, washed with some of the weak mother water, dried by the action of the machine, and then removed for use. The saltpetre thus produced will be equal to the best refined Bengal. (In order to ascertain the proportions of alkali and pure nitrate of soda contained in the solutions previous to mixing, they must be analyzed, and the relative and necessary proportions, say 86 parts of pure caustic alkali to 48 parts of pure nitrate of soda, carefully secured in the respective solutions.)

The specification contains also a method very similar to that above described of making saltpetre from nitrate of soda and American potassas, and from pearl-ashes. In any case where the materials employed do not possess a sufficient degree of causticity, the addition of lime will be rendered necessary, as upon the principle of causticity depends the essence of the invention. The carbonate of soda and saltpetre remaining in the mother liquor after the crystals (probably by any of the above processes) have been removed, are to be separated by concentrating the liquor to about 45° Baumé, and then allowing it to cool, when the crystals of each of these substances form, and may be readily removed.

The patentee states that the alkali obtained by lixiviating the ashes of burnt tobacco may be employed in the manufacture of saltpetre.

Claims.—1. Factitious saltpetre manufactured by the double conversion of nitrate of soda into nitrate of potassa, and carbonate of potassa into carbonate of soda, by the agency of causticity.

2. The manufacture of the same from nitrate of soda and crude carbonate of potassa, rendered caustic by the addition of lime.

3. The manufacture of the same from nitrate of soda and American potassas without any addition of lime.

4. The manufacture of carbonate of soda and caustic soda in the process of manufacturing factitious saltpetre by the double conversion of nitrate of soda into nitrate of potassa, and carbonate of potassa into carbonate of soda and caustic soda.

5. The application of the alkali obtained from the ashes of burnt tobacco to the manufacture of factitious saltpetre.

6. The application of the ordinary centrifugal drying machines to the manufacture of saltpetre.

Improvements in the manufacture of cigars, and certain improved apparatus for smoking cigars. GEORGE AUGUSTUS HUDDART, of Brynkir, Caernarvon, Esquire. Patent dated August 29, 1850.

This invention, as claimed, consists :—

1. In closing and securing the external leaf or wrapper of a cigar with a cement or varnish impervious to moisture, and in applying to this purpose amber, gutta percha, India rubber, or other suitable waterproof cements or varnishes.

2. In dressing or coating the twisted or butt-end of a cigar intended to be introduced between the lips of the consumer, with a thin skin or covering adhering firmly to the cigar, and unaffected by, and impervious to, moisture ; and in the application to this purpose of amber, gutta percha, India rubber, or other suitable substance.

3. In permanently fixing or cementing to the twisted or butt-end of a cigar, tubes, or mouth-pieces composed of amber, gutta percha, or India rubber.

Improvements in the smelting of iron and other ores, and in the manufacture or working of iron and other metals, and in certain rotary engines and fans, machinery or apparatus as connected therewith. ANDREW BARCLAY, OF KILMARNOCK, AYR, engineer. Patent dated September 5, 1850.

The present improvements relate—1. To blast furnaces, of which Mr. Barclay describes three different arrangements. In the first of these the furnace which may be circular or of any other suitable internal shape, is provided with three tuyeres communicating by vertical branches with the main cold air pipe. Each of the tuyeres has a triple branch, furnished with suitable stopcocks, one pipe of which opens into the small end of a bell-shaped chamber, forming part of the furnace, while the other two communicate with it at the sides near its junction with the body of the furnace. The exit orifices of these latter are also bell-shaped, for the purpose of equally diffusing the blast. Each chamber has also a charging tube closed by a double door to admit of the introduction of fuel, while the blast is on. In working with this furnace, fuel and carbonaceous matter are introduced into the chambers in addition to the charge of ores, fluxes and fuel in the body of the furnace ; the blast is then turned on at each central pipe, so that the fuel is speedily ignited ;

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but as the air, which has passed through the incandescent fuel becomes too much deoxidized, more oxygen requires to be supplied, and this is done by turning on the blast through the side pipes of each chamber, the air thus admitted, although in a heated state, containing a greater proportion of oxygen than that which had passed through the fire. To obviate the objection that the heat is unequally diffused in different parts of the furnace, additional tuyeres may be provided, situated at suitable heights and the same furnace will be thus rendered capable of performing the double operation of "combining and separating." In the second arrangement, there are also three tuyeres, the blast pipe in communication with each of which terminates in a forked branch. One arm of this branch serves for admitting air above the burning fuel, while the other conducts the blast beneath the grate bars and through the fire in the chambers to the body of the furnace. A similar result is obtained in the third construction, in which two tuyeres are employed. In every case the blast can be so regulated as to vary the quantity of oxygen contained in it according to circumstances, and the quality of iron desired to be produced. When the produce of the furnace is desired to be converted at once into malleable iron, it is run into ladles at the proper time for charging the puddling furnaces, and poured into the latter in a melted state, thus economising time, labor, and expense; when both combining and separating furnaces are employed, the iron is removed from the former to the latter, in a fluid, or red-hot state, with the addition, at the same time of a sufficient quantity of carbonaceous matter. It is considered desirable, when working furnaces according to this arrangement, to place them on sloping ground, the operations being facilitated by having the floor of the one furnace at a higher level than the charging door of that lastly employed.

2. To an improved construction of blower in which the blast is produced by the direct pressure of steam. This blower consists of one or two vertical cylinders or receivers, which communicate near the top with the pipe for supplying steam at a proper pressure, and have also near the top a clack valve opening inwards for admitting air. At the bottom of each cylinder is a water jet, a small aperture for the escape of steam, and a pipe leading to the tuyeres. The action of the blower is as follows:—Air is admitted by the clack valve till the cylinder is filled, the steam is then turned on, and as the induction pipe terminates inside the cylinders, with a funnel-shaped mouth opening upwards, the pressure of the steam against the clack valve at once closes it, and the steam continues to rush in until all the air is expelled. As soon as this takes place, and the steam begins to escape from the before-named aperture, a jet of water is thrown in, by which the steam is condensed, and air again immediately enters and fills the cylinder, when the preceding action of the apparatus is repeated. The stop-cocks are opened and closed by any suitable mechanical contrivance.

3. To an improved rotary engine of the emission, or reaction class. The casing of this engine, within which the steam arms revolve, is supported in a suitable framing immediately over the boiler, the hollow spindle being placed vertically and in immediate connection with the steam pipe. In the interior of the case is a circle of guide or division pieces, about half an inch apart, and tangential to the centre of the exit orifices of the emission arms on the revolving spindle. The case is much larger in diameter than the circle formed by the outer edges of the guide pieces, so that a clear passage is left all round for the escape of the steam to the waste-pipe. By this arrangement no rebounding of the steam can take place so as to offer any resistance to the revolution of the arms, the steam passing off at once between the plates to the waste-pipe; and by proportioning the weight of the moving parts to the upward pressure of the steam, the friction will be reduced to a minimum.

4. To a fan of peculiar construction, which is shown as being worked in connection with the last described engine, the high speed of which renders it peculiarly adapted to this purpose. It is mounted on the same spindle as the hollow arms in a casing placed above that in which the arms revolve, the spindle passing through a suitable stuffing-box in the lid of the case to admit of this arrangement. The blades of this fan are in the form of an obtuse angle, the hollow part being the impelling surface. By admitting steam at the blast-pipe, so as to act against the hollow of the blades, this fan may be employed as a rotary engine of the impulsive class.

Claims.—1. The system of blowing smelting or melting furnaces by separate and distinct air blasts, combined and applied in the furnace, or its fuel-heating chambers.

2. The use or employment of compound tuyeres for the purpose above set forth.

3. The employment of fuel-heating chambers, forming in themselves parts of the furnace.

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4. The application of tuyeres for simple or combined air and vapor blasts, for the supply of air or vapor at points above the level of the ordinary or bottom tuyeres.

5. The mode of charging fuel and carbonaceous matters at the bottom of the furnace, or at any suitable point below the ordinary charging doors.

6. The use of an escape-valve for the gases or vapors produced by the combustion of raw or green coal where supplied at the bottom of the furnace.

7. The smelting of ores by two operations, whether performed in two separate furnaces, or by the use of upper and lower tuyeres in the same furnace.

8. The use of blowers in which the direct pressure of steam is employed to expel the blast of air from the cylinder or receiver.

9. The application of guide or division pieces within the cases of rotary engines of the omission or reaction class for the purpose set forth.

10. The system or mode of working emission, reaction, or impulsive rotary engines and fans on the same vertical spindle.

11. The use of rotary engines and fans with angular blades as above described.

Improvement or improvements in the construction of gas retorts and furnaces, and in apparatus or machinery applicable to the same. JAMES RENNIE, of Falkirk, gentleman. Patent dated September 5, 1850.

The first of these improvements consists in an arrangement of apparatus by which the retort or retorts are connected with the furnace-door in such manner that the opening or closing, or motion of the latter on its hinges, shall cause the retort or retorts to make a partial revolution, thus bringing every part of the charge under the more immediate action of the fire, and at the same time equalizing the wear of the retorts.

The retorts are formed of clay, but terminate at the inner end in a short metal shaft, which is supported in a plummer block capable of sliding up and down to admit of the retort being adjusted to its level, or, if desired, removed altogether from the furnace. The necks of the retorts are also formed of metal, and have their bearings in plates attached to the front of the setting. The vertical pipe leading to the hydraulic main is connected to the retort by a ball and socket-joint, and has also a second similar joint to admit of its being moved aside when charging the retort. On the lid are formed a ring of teeth, into which gears a paul on the end of a lever supported in a suitable framing, and connected by rods with the furnace-door, so that when the latter is opened by raising the lever, the paul takes into the teeth on the lid of the retort, and causes it to turn. When more than one retort is used, the teeth are made to gear into each other, so that the revolving motion may be simultaneous.

A second improvement consists in lining the interior of the furnace with ashes or some other bad conducting substance.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

ON THE SCAMMONIES OF COMMERCE *

LETTER FROM M. DUBLANC TO M. GOBLEY.

YOU have done me the honor to ask of me some details concerning the observations which I have made in studying the composition of the various kinds of scammony of commerce.

Being greatly led astray by publications which do not throw much light on scientific questions, or which are wanting in powerful interest for the practice of an art, I abstained from publishing some facts concerning Aleppo scammony, collected in 1844.

It appeared to me sufficient that M. Soubeiran described, in the last edition of his *Traité de Pharmacie*, (1847, t. i. p. 393), the characters which distinguish the best scammonies, as well as the differences which may exist in the amount of resin they may contain. The latter circumstance is, according to all evidence, the most worthy of interest, when it is desired to form an opinion of the purgative action attributed to this substance.

Situated as I am, and having under my eyes drugs which have undergone the examination of a commmission composed of most competent and experienced persons, I had often remarked that the scammonies, regarded as the finest of commerce, presented in their appearance not very similar

* *Journal de Pharmacie et de Chimie*, March, 1851.

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characters, and, consequently, were far from ensuring the conditions of a regular and normal medicinal action.

One day, when I had to prepare the resin of scammony, by conforming, according to custom, to the formula of the Codex, I was surprised at the small proportion of resin which the fine scammony I had employed furnished. A second and a third experiment confirmed the first. I had no fear of error in the operation, nor in the result, and I sought to prove that scammony possessing the most favorable characters might be poor in resin. Indeed, 100 parts of substance gave only 17 parts of resin.

I took other pieces of scammony from the same parcel, and made many experiments on the proportion of resin, and I collected fresh and superabundant proofs that scammony, taken in different pieces, chosen with the same care and the same knowledge, might contain very various proportions of resin.

A fact of this nature naturally led to a very important conclusion in a therapeutical point of view, namely, that scammony, when it presents the characters on which its selection is based, does not contain, however, the same proportion of resin, and that there must exist, in its purgative and even drastic properties, a difference proportional to its richness in resin. The seriousness of this circumstance suggested to me the idea of procuring samples of Aleppo scammony from various houses in the drug trade well known for the quality of their articles, and to subject them to comparative analyses.

My experiments gave results which I did not expect, on account of the large proportion of resin extracted.

I give them here in the order of their progression from 100 parts of scammony exhausted of resin by alcohol:

1.	17	per cent.
2.	20	"
3.	22	"
4.	27	"
5.	28	"
6.	36	"
7.	50	"
8.	64	"
9.	96	"

In their simple expression, these numbers establish that scammony may, in a given case, possess a purgative action as 17, and in another as 96;—that is to say, as 1 to 5, or 5 to 1. Consequently, scammony cannot be regarded as a certain medicament in the hands of the physician who employs it. He orders a gramme of scammony; this gramme may represent 17 centigrammes of the purgative principle, or 96 centigrammes. Here the purgative action will be absent or scarcely perceptible, there it will be manifested and may exceed the requirements of the disease.

However, these great differences and these various effects cannot be foreseen or prevented by the characters sought for in scammony. To obviate this inconvenience, the importance of which increases with the energy of the remedy, and the confidence its use inspires, no other means presents itself than to extract the resin of scammony by alcohol, and to substitute it in all cases wherein the extract would be used. Thus, all uncertainty would cease, the action of the resin would be constant or would present only modifications depending on the patient himself or on the disease. The agent employed by the physician will never be behind his calculations.

The doses of resin necessary for producing purgative action have been communicated to me by several physicians. From 20 to 50 centigrammes may be administered from infancy to manhood, and from 50 centigrammes to 1 gramme after that.

I have been able to ascertain that a mixture of equal parts of resin of scammony, sugar and bicarbonate of soda, administered in milk or in saccharine liquids in small quantity, constituted a purgative of certain action and very agreeable employment.

Notwithstanding my promise to be brief, I am compelled, in conclusion, to communicate to you a peculiarity relative to the composition of scammony.

Although Naturalists and Pharmacologists (in their classifications) have arranged for this substance the general name of gum resin, it is remarkable that gum does not form part of its elements, or is contained only in the proportion of one or two hundredths. Scammony consists, independently of the resin, of fecula. The fecula is the part insoluble in alcohol, which was noticed by MM. Bonellon, Lagrange, and Vagel, and the proportion of which they found to be 35 per cent. in Aleppo scammony.

This confession on the part of such distinguished chemists is rendered surprising by the fact that the fecula of scammony partakes without modification, all the properties belonging to that proximate product of vegetables.

I here conclude all the information I have to give you on this subject. I beg you to accept with indulgence the form of the explanation, and to see in my communication only my intention to comply with your desire.

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ON KOSSO.*

To the Editor of THE LANCET.

SIR,—I am happy to see that the Kosso is at length attracting the attention of the medical profession in Europe. Having, when attached to Sir William Harris's mission to Shoa, resided nearly two years in Abyssinia, where it is in constant use as an article of domestic medicine, I trust I may be allowed to add my testimony as to its safety and efficacy, under common care, as an anthelmintic. On our return to India we brought more than half a camel-load of the seed and dried flowers of the Kosso with us, which I believe was forwarded by the Indian government to England.

I add an extract from my "Medical Report to Government on the Kingdom of Shoa," which was published in the *Transactions* of the Medical and Physical Society of Bombay, for the year 1843 :—

"The next disease deriving importance from its extreme prevalence in Abyssinia, is the Tænia Solium (called *wosefat*), which species of intestinal worm attacks all classes, and there are very few natives who are exempt from them. By themselves it is attributed to eating brindo or raw flesh, and they assert that those who abstain from this diet are free from the complaint, but that if it once makes its appearance it is seldom eradicated ; the Abyssinians retaining the opinion that each joint is capable of reproducing a perfect worm.

"Fortunately the country which is so peculiarly the seat of this disease possesses a most efficient remedy in the flowers of the Kosso, which tree being so indispensable to the health of the inhabitants, is carefully preserved, and a group of them is always found in the immediate vicinity of the villages. This valuable anthelmintic is taken by every individual regularly every two months, children commencing the discipline at the age of five or six years, and continuing it for the remainder of their lives. This frequent and indiscriminate use however, gives origin to serious complaints, of which prolapsus ani is the most common; the great exhaustion following its violent action, when injudiciously administered, sometimes even terminating fatally. The continued use of this drastic purgative, though necessary to the preservation of health, must tend to shorten the natural period of existence, for the Shoans are not a long-lived race, and instances of advanced old age are rarely met with.

"Kosso *(Hagenia Abyssinica)*, when in maturity, attains the growth of a moderate sized tree, its red racemes of blossom much resembling in form and distribution those of the horse chesnut. These flowers are first dried in the sun, and all stalk and extraneous matter carefully removed, and are then pounded fine. The dose varies from six to eight drachms weight, according to the quality of the drug and strength of the person, and is drank early in the morning in a cupful of cold water ; if kept mixed for any length of time its power is said to become deteriorated. It usually acts in the course of a couple of hours, the first evacuations being watery and the worm generally expelled by the third or fourth ; during the time of its operation, abstinence from food or drink is enjoined, but afterwards in the evening, the patient is directed to eat freely of hot spiced dishes, and to drink mead or beer. Should five or six hours elapse without indication of the medicine having taken effect, it is recommended to eat a full meal seasoned with hot condiments, which is said to quicken its operation.

"A favourable opportunity occurred of trying the effects of Kosso on a European soldier of the escort, who was troubled with the lumbricus teres, on whom it acted mildly and effectually. Should it be considered a desirable addition to the materia medica of Europe, a plentiful supply of Kosso might be easily obtained at Massowah on the Red Sea, from the merchants of Abyssinia who visit that port, which is but a journey of five or six days from the country of its growth ; or, as it appears of a hardy character, and the climate of Abyssinia seems favorable to northern vegetation, the tree itself might perhaps be successively introduced, by seed, into Europe."

R. KIRK, Surgeon,
2nd Bombay Light Cavalry.
Rajkote, Dec. 10, 1850.

* *Lancet.*

KOUSSO AND THE TAPE-WORM.*

SIR,—I beg to forward for insertion in your journal the following brief record of another instance in which the new remedy Kousso has been successfully employed :—

Mrs. L——, a married female, aged 49, in the middle class of life, came to me a few weeks back with dyspeptic and hysterical symptoms, which, however, presented nothing very remarkable, and were not attributed to their real cause, until it was discovered that she was in the habit of occasionally passing a few joints of the tænia solium.

* *Medical Gazette.*

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After several doses of the oil of turpentine, combined with castor-oil, had been given at short intervals, without success, I advised her trying the kousso. Accordingly she took six drachms of this medicine, in half a pint of warm water, early in the morning, having fasted for the previous fourteen hours, and taken, the preceding night, a large dose of castor-oil, which had acted freely. She described the potion as having been excessively disagreeable, on account of its bulk, but complained still more of its action, although she is now loud in its praise. It began to purge violently in the course of an hour, and with the second evacuation expelled a large dead worm, intermixed with mucous and fæcal matter; for eight hours afterwards there were severe griping pains, and six other copious motions, consisting of nothing else than the kousso, mixed with serum and mucus.

The tænia was nearly seventeen feet long, and broken into three pieces. At one extremity it tapered off to the size of a thread, which makes it appear probable that although the head of the creature was not to be found the entire worm had been ejected.

For some days afterwards the patient suffered from exhaustion, and was under the belief that a portion of the worm yet remained behind. In order to test the reality of this, I gave her, after the expiration of three weeks, half a drachm of the oil of male fern, mixed with mucilage, twice daily, for three successive days. This acted as a diuretic and purgative, but without affording further evidence of the tape-worm. The patient has now lost all her dyspeptic and nervous symptoms, and is perfectly well.

The kousso was obtained from Mr. Hooper, of Pall Mall East, who had procured it from a different source to that which had been used in former cases. In most instances where it had been administered its action has been so slightly purgative as to require the subsequent use of castor-oil, or some other aperient; but its effect in the present case seems to have approached nearer to that which takes place amongst the natives of Abyssinia, in whom it invariably produces active purging. This appears to be a matter worthy of notice, since, the more closely it resembles the action it has upon the people of the country where it is so famed, the greater must be the chance of its purity and the prospect of its success.

Now that kousso is likely to become less expensive, and that experiments may be made with it without the risk of ruining our patients,* it would be well to ascertain whether a smaller and less violent dose might not be equally serviceable.

I remain, sir,
Your obedient servant,
RICHARD PAYNE COTTON, M.D.
Assistant-Physician to the
Hospital for Consumption.
4, Bolton Street, Piccadilly,
Feb. 18, 1851.

EFFICACY OF KOUSSO IN THE TREATMENT OF TAPE-WORM.†

SIR,—As it is only by multiplying the reports of successful cases that the value of any new medicine can be accurately determined, I beg to contribute my mite in favor of the virtues of kousso as an anthelmintic for tænia.

CASE...Mr. P. consulted me on account of the sufferings produced by this worm. He informed me that for some time past he had passed joints of tænia. His ailment consisted principally of a great sense of prostration in the epigastrium, aching pains in his limbs, debility, nervousness, with unfitness for his duties, and a general feeling of *malaise*. He had some obscure and transient pains about the umbilicus. His bowels were habitually relaxed, and his appetite bad. He had some time back taken turpentine, and considered that it had benefited him, although it had never done more than expel separate joins of the tænia. Latterly he had taken such an aversion to that medicine, that nothing would induce him to repeat it.

Kousso was administered in the following manner, according to the directions transmitted with the drug.

The patient was limited for two days to gruel. On the evening of the second day he took ℥ss. of castor oil. The next morning he took 3vj. of the kousso (infused in half a pint of lukewarm water for a quarter of an hour), drinking the whole powder with the water. This rather bulky dose was washed down by lemon-juice and water. It produced a slight degree of nausea, probably from its bulk. As the bowels had not operated four hours afterwards, he took ℥ss. of castor oil. Shortly afterwards the worm came away in the motion. It was passed rolled up in a ball. It was found to measure six yards. The head, unfortunately, could not be dis-

* This dose cost a sovereign; but Mr. Hooper is now selling it at half that price.

† *Medical Gazette.*

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covered; but as the worm was somewhat torn while being unravelled, it is possible it may have been pulled off. The manner in which the worm came away would lead one to suppose that it had passed entire. The medicine operated most mildly, and the patient expressed himself willing at any time to repeat the dose.

I am, your obedient servant,

EDWARD WELLS, M.D.

Reading, Feb. 26, 1851.

OIL OF MALE FERN IN THE TREATMENT OF TAPE-WORM.*

WE had the pleasure of putting upon record, a little time ago, the success Dr. Budd had met with at King's College Hospital, in using the oil of male fern for the expulsion of tape-worm, (THE LANCET, Dec. 21, 1850, p. 676.) We are glad to say that the drug was likewise very effective in the hands of Mr. Erichsen, University College Hospital. We lately noticed a little girl, an out-patient under the care of Mr. Erichsen for a cutaneous affection of the leg, who took the oil of male fern, as she had passed some fragments of tænia. The remedy proved very effective, the child having voided several yards of the worm, after taking half a drachm of the oil in mucilage. We hope that such experiments will be continued, as it is a matter of no small importance fully to ascertain the virtues of a plant so easily procured.

CRYSTALLISED CHLORIDE OF CALCIUM IN DISEASES OF THE SKIN.†

BY M. CAZENAVE.

CHLORIDE of calcium, which forms the basis of M. Chevallier's *Pommade Antidartreuse*, which was formerly prescribed by M. Biett at the Hôpital Saint-Louis, and which has since fallen somewhat into oblivion, has lately been again recommended in diseases of the skin, by M. Cazenave, who states that he has derived marked advantage from it, especially in forms where there is a predominance of the lymphatic temperament, in chronic eczema, and impetigo. The dose recommended by M. Cazenave is from one to two grammes per day: the formula which he employs is the following:—

℞ Crystallised chloride of calcium 15 gr.
Distilled water ..... 500 „

One dessert-spoonful, twice or three times a day, in any suitable draught.

* *Lancet.*

† *Annales des Maladies de la Peau.*

ON EXTRACT OF HENBANE.*

BY MR. CHARLES CRACKNELL.

I HAVE selected extract of henbane for my subject this evening, not only on account of its being one of the most useful and most powerful extracts prepared from any indigenous plant, but because it elucidates what I am about to state, and exhibits the differences I am about to describe in a more marked degree than any other extract, and consequently requires the greatest amount of care in the preparation of it.

In order to render myself as clearly understood as possible, I shall speak separately of the three most important circumstances to be attended to in the making of the extract.

Firstly.—The selection of the herb.

Secondly.—The expression and evaporation of the juice.

Thirdly.—The result.

First then the selection of the herb—and this is manifestly a very important division of my subject, for a good product is not likely to be obtained from a bad or unfit material—yet, notwithstanding its importance, it is the very thing least attended to. Our Pharmacopœia (I hope soon to have the pleasure of saying our *late* Pharmacopœia) gives a licence for gathering the plant which I cannot but think quite unjustifiable, and which defies at least all uniformity of result, and most writers on the subject confine themselves to the manufacture of the extract. For reasons to be presently stated, I believe that henbane is only in a fit state for extract during a very short period, that is to say, when the flowers at the summits of the plants and its branches are blown, but before they show any symptom of fading. If the plants have been carefully gathered and sent to London, and have not grown amongst high weeds, the leaves will then be green to the bottom of the central stem, the seed vessels and seeds which are formed will be soft and juicy, and the weight of the plant will reside in the leaves and stems: if it be allowed to stand a little longer the lower leaves become more or less yellow—the seed vessels, particularly the lower ones, become hard and prickly—the seeds assume a brownish color, and on holding the plant by the lower part of the stem, it will be perceived that the weight then resides chiefly in the top. Of the immature plant but little is met with in the market: a description of it is obviously impossible, as I should call it too young at

* *Pharmaceutical Journal*, March, 1851.

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any period before the one first mentioned; the extract yielded by it I shall describe presently. Much has been said at various times about the relative strength of the extracts made from annual and biennial hyoscyamus, and I believe that the opinion is gaining ground that they may be used indiscriminately. It is not my intention to dwell upon this part of the subject now, but I may remark in passing that the physical characters of the two plants and their extracts differ considerably, and in the absence of proof, I have no hesitation in deciding in favour of the biennial—such then is the plant I always use, and to which my present remarks refer.

I now come to the preparation of the extract. The market bundles, which are always more or less heated, should be opened immediately they are received, and the herb spread in a cool place: the leaves, flowers, soft stalks, and seed vessels should then be stripped from the large hard stalks as quickly as possible, ground in a mill (without being sprinkled with water as directed by the Pharmacopœia, as there is already more of that ingredient than the careful operator desires) and the juice expressed, strained through some coarse material, and conveyed to the evaporating pans. I may here remark, that the practised eye can predict the quality and character of the extract by looking at the juice. The juice yielded by the immature plant is of a bright grass green color; that by the plant of proper age is of a deep dull green color, such as would be produced by a certain mixture of brown and green; and that by the plant when too old is of a brown color, with some green coloring-matter floating in it, which speedily settles to the bottom. In a valuable paper read in this room on the 13th of November, the process of evaporation was so ably discussed that little remains to be said on the subject. I believe the best methods, and which are always at command, to be a water-bath, or the passing a current of warm air over the surface of the juice. Among the advantages of this latter process stated by Mr. Archer, there is, however, one with which I beg to differ: he says, "The evaporating liquid requires no stirring, or other attention, from the commencement to the conclusion of the process." Now in practice, I find, that an inferior extract (not of course in strength, but in other qualities which I think very essential) is obtained by leaving the juice to itself to that which results from constantly stirring it; stirring accelerates the evaporation, and produces an extract more convenient for the use of the dispenser, inasmuch as it is less adhesive, and can consequently be weighed in small quantities with much greater facility and dispatch.

I now come to the last division of my subject—the result; the quality of which must, in a great measure, depend on the efficiency with which the two first have been conducted. Strength, doubtless, is one of the most important properties of the extract, but there are other qualities not less important, and which I think should never be sacrificed for obtaining a slight increase of it—such are durability and convenience; and to procuring these in combination with a strength which (although by certain process it might be exceeded) I have never found equalled in the extracts of commerce, I now wish particularly to draw attention; the most important proceeding for obtaining such a product is the selection of the plant; there is only one time when it will yield it, which is the time already mentioned, and then the albumen and the deliquescent salts of the juice are so nicely balanced, and the product yielded so unexceptionable, that we may fairly look upon it as one of those wise arrangements of Providence which adopts every thing to the use and benefit of man. If the plant be gathered too young, it will yield an extract not only deficient in strength, but possessing neither of the other necessary qualities --it is of a crumbly nature, dries very rapidly, becomes fetid and mouldy, and in a very short time totally unfit for use. If the plant be too old, it will yield an extract very strong I believe, but void of durability and convenience, for it soon becomes fetid, which indicates change, and is very deliquescent which is extremely inconvenient. The same may be said of extracts from which the albumen has been separated, a process which I do not think advisable under any circumstances, for I found the extracts made from the flowering plants of the very rainy season of 1843, keep exceedingly well for one year; some of them I kept more, in fact there is on the table some extract of hemlock which was then put into the same pot in which it now is, and has been purposely kept without being moved or meddled with. It has lost the fine green color which it once possessed, but on dissolving a few grains in liq. potassæ last evening, and comparing it with a similar solution of last year's extract, I could not perceive any difference in the strength. I believe that if the herbs were well dried and carefully kept for twelve months, they would then yield, by treating with water, an extract much stronger than

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any that can be made from the green plant, but such extracts do not keep well, and are very deliquescent. Great strength then is not the only requisite of a good extract; it matters little to prescriber or patient whether four or five grains be ordered or taken, but it is very inconvenient to both dispenser and patient to have a box of pills in less than a week becoming soft, and running into a mass, which must be the case unless some dry powder be used in making them, which of course does away with the advantage of the additional strength; it is moreover very important that extracts should be of the same strength at one time of the year as at another, and such they cannot be unless they be made with every precaution to prevent change. Besides the extracts of hemlock, already mentioned, there are on the table three samples of extract of henbane, made in the month of June, 1848, 49, and 50, which have been kept in pots merely tied over with brown paper, and have undergone no change worthy of notice, and this is the best proof I can give of the value of the process I have been describing.

107, *Edgware Road*,
8*th February*, 1851.

Mr. Bell agreed with the author of the paper in considering that the biennial plant yields a better extract than the annual. He believed, however, that the annual plant was very generally used in consequence of its yielding a larger quantity of extract than the biednial.

The Chairman corroborated Mr. Bell's statement, in reference to the relative quantities of extract obtained from the two varieties of henbane. He observed, with reference to the preservation of the extract, that the length of time during which it might be kept depended very much on the extent to which it was exposed to the air. Turning it from one pot to another would cause it to spoil sooner, by exposing a fresh surface.

Mr. Cracknell said he had no doubt that the extract made from the biennial plant was better than that made from the annual, yet some botanists assert that there is no difference in the plants.

THE SALE OF ARSENIC.

Lord Carlisle's bill to regulate the sale of arsenic, now in the House of Lords, has been printed. It declares that the unrestricted sale of arsenic facilitates the commission of crime. The bill provides, that on every sale particulars of the sale shall be entered by the seller in a book before the delivery of the arsenic, and every such entry is to be signed by the person selling the same. Any person selling arsenic, save as authorized by this bill, and every person giving false information to obtain arsenic, are to be summarily convicted before magistrates, and to be liable to a penalty not exceeding £20. The bill is not to prevent the sale of arsenic in medicine under a medical prescription. A recent case caused the introduction of the bill.

CONIA, SULPHATE OF CADMIUM, &c., IN CERTAIN SPECIES OF OPTHALMIA.*

BY DR. FRONMULLER.

Conia, which is, as is known, the active principle of the *conium maculatum*, has, according to Dr. Fronmüller, given some surprising results; he employs it in scrofulous opthalmia, accompanied by blepharospasma and pholophobia. He employs a solution of

℞ Conia	20 centigr.
Distilled water	20 grammes
Alcohol	13 decigr.

applied several times a day in friction round the eyelids. Dr. F. also says that he has obtained excellent results from the sulphate of cadmium used as a collyrium against films of the cornea, according to the following formula:—

℞ Sulphate of cadmium	20 centigr.
Distilled rose water	45 gr.
Rousseau's or Sydenham's laudanum, according to circumstances	2 to 6 gr.

To form a collyrium, which is to be dropped into ulcers of the cornea accompanied by violent pains. Dr. F. is perfectly satisfied with the administration of Dover's powder.

The author also recommends tannin in the forms of pommade and collyrium, because, says he, this vegetable astringent is preferable to the mineral agents of this category, inasmuch as it is more supportable, and yet produces an energetic contraction of the vascular tissue.

The following are the formulæ which he adopts:—

For the Pommade.

℞ Tannin	40 to 60 centigr.
Washed lard	25 decigr.

For the Collyrium.

℞ Tannin	30 to 60 centigr.
Distilled water	60 gr.
Rousseau's laudanum	2 to 4 gr.
Mix	

* *Annales d' Oculistique.*

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ON ALCOHOL, CONSIDERED IN A TOXICOLOGICAL POINT OF VIEW.*

BY M. MORIN.

THE detection of alcohol in a case of poisoning is one of the most difficult problems of chemical jurisprudence, on account of the very diffusible property of that liquid.

Having been several times called upon to determine the existence of alcohol in cases of death following intoxication, we were unable to do so, but the experiments were made a long time after death. The last case in which we operated was the following.

A man named G., after having passed several hours in a *maison de tolerance*, drank a large quantity of brandy, which produced great exaltation of ideas, and, doubtless, intoxication. He was soon required to pay certain expenses, and on his refusal, a violent conflict ensued.

Next day, the body of this unfortunate man was found in the Seine. Dr. Bechet, who made the post mortem examination, was struck with the ethereal odor disengaged from the body. The stomach was sent to us, with the liquid which it contained. Our first care was to put this liquid into a carefully-corked flask, in order to prevent the further volatilisation of the liquid, the odor of which evinced the presence of ether.

The liquid contained in the organ had, independently of the odor which we have mentioned, a very distinct acid reaction. This latter property did not surprise us, for we have several times proved the existence of acetic acid in some cases of death from intoxication.

It is known, moreover, that this acid is produced in large quantities in bad digestions. The remarkable acidity of the liquid of the stomach suggested to us the mode of operating which we now publish, and which arose from the fear of converting the alcohol into ether by the agency of the acid.

Consequently, we saturated the liquid with bicarbonate of soda, until effervescence ceased: the preference was given to this salt for the saturation of the acid, instead of the protocarbonate, on account of its having only a very feeble action on organic matters. Afterwards, we proceeded with the distillation, observing the precautions necessary for obtaining liquids so volatile as alcohol and ether. When half the liquid contained in the retort was obtained, the apparatus was disconnected, and the receiver was found to contain an aqueous liquid, slightly opaque, and of an evident ethereal odor and taste.

The product of the distillation, introduced into a flask, carefully stopped, was treated with pure carbonate of potassa until no more was dissolved, and, leaving the mixture to itself, there appeared on its surface a slight layer of a liquid which possessed the odor already noticed and the property of inflaming, like alcohol, on being brought near a candle.

The presence of alcohol and ether being proved, it was important, in a scientific point of view, to ascertain if the victim had or had not swallowed ether. It was proved that this man enjoyed perfect health, and had not been under medical treatment for a long time. Now, the ether was formed in the stomach; but how is its production explained? Is there developed, under the influence of life, an elevation of temperature capable of favoring the etherification of the alcohol by the contact of the acetic acid or of the other acids contained in that organ? This proposition cannot be admitted. Is it not more probable that the animal diastase, recognised by M. Mialhe in the saliva, secreted more abundantly by the passage of the alcohol into the mouth, being mixed with that liquid, gave rise, by a sort of catalytic power, to the ether? This hypothesis would be admissible in the presence of several curious results recently obtained: namely, that disaggregated starch, kept in the mouth for a few minutes, is converted into glucose.

The action of the saliva on amylaceous matters accounts for the existence of sugar in the blood and in the liver, in which it has recently been found.

The results of this work demonstrate that we must not neglect, in these cases, to tie the stomach carefully, and preserve it in a perfectly closed bottle.

If, hitherto, it has been impossible to prove the existence of alcohol in cases of death from drunkenness, it is because chemists are unaware of the formation of ether in such circumstances, and owing to the neglect of the precautions for the preservation of such volatile liquids as those in question.

* *Journal de Chimie Médicale*, March, 1851.

CHEMICAL MEANS FOR THE PREVENTION OF BED-SORES.*

To the Editor of THE LANCET.

SIR,—I wish to communicate to my professional brethren, through the medium of your journal, a very simple means of preventing the urine of persons suffering dementia, paralysis, &c., which is usually

* *Lancet.*

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passed involuntarily, from excoriating their skin, and producing extensive and sloughing sores.

To those in charge of large establishments for the insane, of general hospitals and workhouses, these sores are often most painful to witness, most difficult to manage, and tend to the rapid destruction of the patient. They are commonly supposed to arise from the pressure of the sacrum and other prominent parts, in the long period of the recumbent posture; but I am satisfied that though this may be an assistant cause, the main one is the irritating quality of the urine, with which the clothes of the patient and of his bed become wetted, and which rapidly decomposing, excoriates the skin by the ammonia which is disengaged, and which keeps up a distressing irritation afterwards, leading to the bed-sores alluded to.

To prevent this has long been a desideratum; and the success of the method I now make use of has been most gratifying to me, and to several friends who have witnessed its results.

The principle of the plan is to make use of a medium which will absorb the ammonia of the decomposing urine, without injuring the skin in return, and this I effect by the aid of dilute sulphuric acid. The application of the method is the following:

I have a case made of soft linen, large enough for the buttocks of the patient when lying on his back to rest upon, and to extend a little way down the thighs, and on each side of him. These cases I stuff with bran (previously sprinkled with dilute sulphuric acid) to such a degree as to make an easy cushion, which receives the urine as it dribbles from the patient, the ammonia of which is absorbed by the sulphuric acid, and the skin is left uninjured by the urine.

The proportion of dilute sulphuric acid to the bran I find to be about two ounces of dilute acid to one quart of bran, by admeasurement. The dilute acid is that of the pharmacopœia, and the quantity will be found not to wet the case of the cushion, and only to make the bran itself feel in a slight degree moist.

The same quantity of bran put into a fresh case, and sprinkled with a little fresh acid, I have found serviceable and inoffensive for several days, but I should advocate its being renewed every alternate day, at least.

To persons able to walk about and incontinent of urine from the many causes occasioning it, I have found the same means productive of the greatest comfort, by sewing a small bag of the prepared bran to the side of the trowsers on which the penis is worn.

I use the same application (substituting deal saw-dust for bean, for economy's sake) on the floors of those of the insane who will be wet and dirty in their bed-rooms, in the urinals of those patients whose urine is disposed to rapid decomposition, and to occasion oppressive effluvia in the bed-chamber, in the water-closets, &c.; indeed, wherever ammonia is disengaged, and renders the air of the chamber oppressive.

But its valuable application is in the prevention of bed-sores, and I could give many cases illustrative of the fact, but they would crowd your pages unnecessarily. If our brethren will give the method a fair trial they will save themselves an infinity of anxiety, and their patients an inconceivable amount of suffering.

I am, Sir, faithfully yours,
SAMUEL HITCH.
Sandywell Park, Cheltenham, 1850.

THE KEY-TSE-SING, OR JAPANESE EMMENAGOGUE.*

To the Editor of THE LANCET.

SIR,—May I request the favor of your inserting the following cases of the successful use of the above remedy in my own practice, and at the same time allow me to inform the medical officers of public institutions, that I shall be happy to forward them sufficient for a more extended trial upon being apprised of their wishes.

* * * * * *
* * * * * *

I have the honour to remain,
Yours, very truly,
EDWARD WILLIAMS, M.D.
Upper Clifton-street, Finsbury,
March, 1851.

CASE 1.—Miss W. L—— applied to me, September 6th, for relief from severe attacks of hemiplegia and hæmatemesis, which had existed for several months, and referred to cessation of the menses from catarrah, in March last. She had been under several practitioners, who had prescribed both lotions, mustard-cataplasms, and aloetic and steel purgatives, with little or no amelioration of the symptoms, and with no effect upon the uterine functions. I therefore put her under the influence of key-tse-sing, and in four days from its employment, the catamenia appeared, and flowed normally for three days, with considerable diminution of the previous symptoms. The effects produced before the catamenia ap-

* *Lancet.*

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peared were slight retching and purgation, with a sense of bearing-down.

At the following menstrual period, I advised her to take a few doses of the remedy; the result was as wished, and she has since been regular, while the head and stomach affections have ceased to annoy.

Case 2.—The daughter of a clergyman, in Berkshire, was sent up to town to consult me in October last. The history of her case was, that two years since, menstruation, which had been previously regular, ceased, without any assignable cause, and that contemporaneously her mind became affected to so great a degree that temporary seclusion was advised and adopted, but all other secretions were in a generally healthy state. Various eminent practitioners were consulted, and many plans of treatment adopted, with little benefit to the mental malady, and with no advantage to the secretive function. I recommended the continuance of the local treatment, and the exhibition of the key-tse-sing, a few days before the next catamenial period. The result was, a scanty flow for a few hours, which seemed to have a slightly beneficial effect; but suspecting that habits of masturbation had been indulged in, I suggested a plan to obviate the same, and a recourse to the remedy at an interval of three weeks, which was attended to, and the result has been most satisfactory, the catamenia being tolerably profuse and regular, while the irritability, waywardness, and suspiciousness have considerably decreased, and she has begun to devote some of her time to those objects and amusements indicative of returning rationality.

Case 3.—Mary W——, aged twenty, a domestic servant, consulted me Oct. 21st. She stated that she had never menstruated, and had been subject to fits since the age of fourteen, which had caused her the loss of several situations. Her appearance indicated good health, and all the other secretions were normal. She had taken various popular remedies, and had been a patient at two of the metropolitan hospitals, without any alleviation; in fact, the fits had increased in frequency and duration. She stated that she had never known any of the usual symptoms of menstruation, and as there was no tumefaction of the abdomen indicating retention, I was very doubtful if the key-tse-sing would be of any use, but determined to give it a trial, as the patient resided in the neighbourhood, and I could watch its effects. I therefore desired her to take four drachms every four hours, which caused severe vomiting and purging after taking eight doses. I then abstained for twenty-four hours, and commenced again with three-drachm doses every eight hours. The same results occurred in a diminished degree, with the addition of severe darting pain across the back, and along the course of the suspensory ligaments, and a sense of weight and bearing-down, which was followed on the 5th day by a pale catamenial discharge. On the seventh day after the menstrual appearance she had a slight fit, and on the recurrence of a monthly period I administered three-drachm doses twice a day; these had the effect of establishing the secretion, which since, with one exception, has flowed regularly, and she has also entirely recovered from the epileptic attacks to which she had been subject.

ACONITE IN SKIN DISEASES.*

BY M. CAZENAVE.

Aconite has long been extolled in constitutional syphilis, chronic rheumatism, and cancerous affections; it has been recommended by M. Fouquier in dropsy: of late years, it has also been much praised by MM. Eardes, Jessier, and particularly Fleming, in whose hands it has given very satisfactory results in augina, whooping-cough, neuralgia, and especially puerperal fever. M. Cazenave prescribes this medicine in diseases of the skin; for a long time, says he, since having proved that in in papulous affections of the skin it is of the first importance to attack the luperesthesia of the skin of which the eruption is only a consequence, I have employed the extract of aconite with success in the dose of from 5 to 10 centigrammes a day. Under the influence of this medicine, I have often seen the itching stage rapidly diminish, then cease, and with it very intense eruptions, which were kept up by the irresisistible desire of scratching, and aggravated by the action of the nails. I used the following formula:—

℞ Alcoholic extract of aconite 1 gramme.
Extract of taraxacum..... 1 gramme.
For 40 pills—one to be taken morning and evening.

POWDER OF PHOSPHATE OF LIME IN SCROFULOUS AFFECTIONS.†

BY M. BENEKE.

Phosphate of lime..... 1 gramme.
Sugar..... 2 „
F. S. A. ten powders. From two to five per day for children from two to ten years old.

* *Annales des Maladies de la Peau.*
† *Repertoire de Pharmacie*, March, 1851.

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SOLUBLE IODIDE OF STARCH AND SYRUP OF IODIDE OF STARCH.*

BY M. MAGNES-LAHENS.

I TAKE

Starch, suitably baked	9 parts
Iodine	1 part

I reduce the iodine to fine powder, and add first a small quantity of the starch, the remainder of which is afterwards mixed with the iodine by powerful and rapid trituration. The mixture, rapidly operated, is introduced into a small matrass, which I cork and place in a boiling water-bath. After from 15 minutes to an hour, according to the quantity of the mixture, the latter, which is of a grey color when it is introduced into the matrass, becomes of so intense a blue that it appears almost black. The small quantities of vapor of iodine which are at first disengaged are absorbed by the powder, which is agitated from time to time. The product obtained, in order to be in all respects similar to the powder of iodide of starch of Dr. Quesneville, should be washed in alcohol, which removes from it the traces of iodine not intimately combined with the starch.

It is an indispensable condition to the success of the operation that the torrefied starch be left for some time exposed to the air, in order that it may attain the hygrometric state in which it existed prior to the torrefaction. I have failed several times in my attempts, and was obliged to abandon this mode of preparation as bad, although very advantageous, through having at first neglected the precaution which I now point out.

As soon as I had discovered the secret of the preparation of the soluble powder of iodide of starch, I prepared with it the syrup of iodide of starch, of perfect limpidity and of a magnificent violet blue, in no respect inferior to Dr. Quesneville's syrup. To obtain it, I tried several modes of operating: the following is that which I have decided on.

Soluble iodide of starch	25	grammes
Water	332	,,
Sugar	666	,,

I introduce the iodide and the water into a matrass, which I place in a boiling water-bath, and when the solution of the iodide is complete, I add the sugar finely powdered: I cork the matrass and agitate occasionally until the sugar is dissolved: I finally put the syrup while still hot into a bottle, which I carefully cork.

* *Journal de Médecine de Toulouse.*

The powder of iodide of starch containing one-tenth of its weight of iodide, the syrup obtained contains 2·5 grammes of iodine per kilogramme, that is to say, the quantity directed by Dr. Quesneville for his syrup.

There is a two-fold reason for not raising the temperature too high, and for not maintaining it too long in the confection of the syrup. Indeed: 1st. The higher the temperature is raised, and the longer it is maintained, the greater tendency has the iodine to be converted into hydriodic acid. 2nd. Under the same influence, cane sugar is rapidly converted into glucose. I have proved by several experiments that iodide of starch has the property of effecting this curious transformation.

I was not therefore surprised to find that Dr. Quesneville's syrup contained only modified sugar, and that it acts with reagents, after the iodide of starch has been precipitated from it by twice its weight of alcohol at 33 degrees, in exactly the same manner as glucose. Like the latter, it is uncrystallisable, cannot be converted into grains of sugar, and instead of passing into that state which is so well known to pharmaceutists and confectioners, it becomes viscid, and may be drawn out like glass, when very concentrated.

When cold, the action of iodide of starch on cane sugar also takes place, but in a far less degree; it is probable, however, that time might render the transformation complete.

In a certain respect, it is unfortunate that this transformation takes place, because it will give to the numerous fraudulently disposed persons a facility for substituting, in the preparation of syrup of iodide of starch, glucose for cane sugar, without its being possible to detect their fraud. In another respect, the transformation might become useful: in the case where iodide of starch imperfectly washed in alcohol might be employed, and consequently containing free iodine, because this metalloid dissolves better in glucose than in syrup of cane sugar.

NOTICE.—*All Communications, Books for Review and Substances for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th*

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

CONTRIBUTIONS TO THE HISTORY OF MANGANIC AND HYPERMANGANIC ACIDS.*

BY MM. PERSONNE AND LHERMITE.

(Concluded from page 296.)

HYPERMANGANATE OF SILVER.

We have obtained this salt in crystalline needles by cooling, and under more massive forms, by spontaneous evaporation, at the ordinary temperature. The color of its solution approaches more to violet than that of the permanganate of potassa. Submitted to the action of heat, it begins to decompose only at 266° F., but the destruction continues at 255° F.; when this temperature is maintained until gas is no longer produced, it may afterwards be carried to 482° F. without the quantity of elastic fluid increasing. The oxygen thus disengaged, calculated by weight, amounts to 10·5 per cent., which corresponds to 3 equivalents.†

The residue of the calcination at 255 to 266° F. is formed of oxide of silver and binoxide of manganese. We ascertained, by direct experiments, that neither of these two bodies lost oxygen at 482° F. Thus the result of this operation very clearly shows the proportion of oxygen contained in the salt.

1gr. 346 of hypermanganate of silver maintained for a long time in an oil-bath at a temperature of 257-266° F., afterwards raised to and kept for an hour at 446° F., gave as a residue 1gr 217.

Of the latter we took 1gr.17, which was exposed in a small porcelain crucible to the heat of a reverberatory furnace; the weight was reduced to 1.05gr. Thus in 100 parts of the salt employed, the residue was represented by the following cyphers:—

In the oil-bath at 428° F..	90·41
At a cherry-red heat....	81·2

The latter residue was composed of metallic silver in very small globules and brown oxide of manganese. We took of it 1gr.039.

Nitric acid dissolved it entirely.* Hydrochloric acid was added, the solution was evaporated to dryness, and the chloride of silver was washed and collected. Then the liquors, combined and submitted to ebullition, were treated by carbonate of soda; the precipitate having been washed, dried and calcined, we obtained—

	gr.
Mn^3O^4.....	0·44
Chloride of silon	0·803
Corresponding to silver ..	0·604

In seeking, by calculation, to find out from what fraction of the salt employed the foregoing results proceed, we arrive at the following proportions:—

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* *Journal de Pharmacie.*

† When the temperature is rapidly raised to 295-302° F., the salt explodes, and the vessel is blown to pieces.

* Nitric acid, in contact with brown oxide of manganese, only partially dissolves it; but here the silver, which removes the excess of oxygen from the manganese, facilitates its solution at the same time as it effects its own.

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Salt employed	100
Residue at 266° F.....	90·4
Oxygen disengaged at 446° F.	9·6
Residue of the reverberatory furnace	81·2
Oxygen disengaged	18·8
Silver.....	47·9
Oxyde MnO	30·7

In another experiment, 0·468gr. gave in the oil bath 0·047 of oxygen, or 10 per 100. In this latter experiment, the tube containing the salt communicated with the atmosphere of a bell-glass receiver placed over mercury. The gas collected was about 36cc. 5 at 75° F., under the pressure of 76mm.

Which gives oxygen 0·0478gr.

In a third experiment, 1·0525gr. gave oxygen (by the balance) 0·1045 gr.

Oxygen measured at 77° F., and 760mm. 74·5cc.

In all these experiments, the oxygen obtained was always less than indicated by theory, owing to the difficulty of obtaining the hypermanganate of silver perfectly dry without incipient decomposition.

We endeavored to obviate this cause of error by estimating the oxygen in the same way as with the salt of potassa. Unfortunately, the salt of silver, being sparingly soluble, only inconsiderable quantities can be operated on, without having embarrassing proportions of liquid.

We put in the test vessel 50cc. of arsonious liquor of 2·213gr. per litre; then some solution of hypermanganate of silver was poured in until a slight rose tint was manifested and remained. The chloride of silver being deposited, was not troublesome in this reaction. This chloride was collected, washed, dried and fused: its weight amounted to 0·065gr., which corresponded to oxygen 0·00362gr.. Now the oxygen yielded to the arsenious solution amounted to 0·017885, that is to say, to five times the quantity combined with the silver to form the salifiable oxide.

The composition of this salt, therefore, agrees with the formula AgO, Mn^2O^7.

MANGANATE OF POTASSA

We have ascertained the minimum temperature at which the green camelion is produced. Peroxide of manganese mixed with a solution of potassa, and submitted to the action of heat in a close vessel, begins to color the alkaline liquid when it is sufficiently concentrated to solidify by cooling, and to boil at 356° F. By comparing this fact with that which we have already said concerning the alterations which the hypermanganate undergoes by the action of heat, we concluded that the formation of the manganate takes place only between 356° F. and the cherry-red heat produced in a small reverberatory furnace. Dull red heat appears to us the best degree for giving a maximum effect.

If the potassa, mixed with manganic oxide, be subjected to the action of heat and a current of oxygen, a large quantity of red camelion is formed, as was proved by MM. Chevillot and Edwards; these chemists even thought that the presence of the air was necessary for the formation of green camelion; but M. Mitscherlich has shown that this body may be obtained by heating to redness, in close vessels, the matters which furnish it. We have ourselves produced it abundantly also by operating in close vessels, at a temperature between 356 and 392° F.

But the presence of oxygen or carbonic acid is necessary for producing the hypermanganate. It is easily perceived that these two bodies differ as much by their mode of acting in this case as by their intimate nature and general properties: the oxygen going to the acid, causes it to pass directly to a more advanced state of oxidation; the carbonic acid, by saturating the excess of potassa, removes from the manganic acid its condition of existence, as we shall see further on. There results from it a more oxygenous acid, which remains in solution, and an oxide consequently less oxygenous which is precipitated.

By referring to what we have said of the action of heat on the hypermanganate of potassa, it will be easy to foresee the conditions of temperature most propitious to its formation. To obtain the greatest possible quantity of it, the temperature of 392° F. must not be much exceeded.

The calcination of a simple mixture of caustic potassa and peroxide of manganese, made in these conditions of temperature, is the surest means, and perhaps the most economical, for preparing pure hypermanganate of potassa. The following is the manner in which we proceed: the caustic potassa is fused on a moderate fire, the peroxide is added, and the mixture is heated and kept moved with a spatula to prevent the manganic oxide from depositing on the bottom of the vessel. When the matter has lost almost all its fluidity, it is left to solidify by cooling; then it is pounded, in order to reduce it into small lumps, which are introduced into a large porcelain tube. This tube is placed in a long furnace, heated to a degree below the dullest red; one of its extremities is put in communication with a gasometer full of air or oxygen gas, or with aspiratory vessel.

As a guide in the operation, the gas is

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compelled to bubble through a washing flask before passing into the porcelain tube, and after leaving it; the proportion of the number of bubbles given in the same time by the two flasks, and which must be determined as soon as the apparatus, being fitted up, enables us to follow with the eye the fixation of the oxygen, and to give the degree of heat most favorable to a maximum effect. It is stopped when, under its influence, the absorption is no longer perceptible.

The color of the crystals of manganate of potassa differs little from that of the crystals of permanganate, at least at first sight; like them they seem black, with moderate reflections. According to M. Mitscherlich, they give with pure water a red solution; we think that that is the case only when the salt has been decomposed by carbonic acid or by the humidity of the atmosphere into hypermanganate and binoxide of manganese. This transformation is evinced by the tarnished appearance of the crystals, which still retain their forms: when they are taken before this decomposition, they give a green liquor which speedily turns red. Perhaps they present their primitive lustre only when they retain an excess of potassa, without which the manganic acid could not exist for long. Such is the conclusion which may be drawn from the following experiment, which teaches us besides that the color of the neutral manganate of potassa is probably red, and not green.

If we put bicarbonate of potassa into green camelion, the solution immediately turns red, as if an acid had been used. In making this mixture in a stoppered flask, so as to avoid as much as possible all extraneous influence, we see, only at the expiration of some hours, the same deposit form as the green camelion gives when it turns red by the action of the air.

M. Chevreul well observed that carbonic acid, at the same time that it turns green camelion red, determines the deposition of a small quantity of oxide; but he had not accounted for it, and regarded the acid of the two camelions as identical. This is only partly true; there must exist in the red liquor immediately after the addition of the bicarbonate of potassa, the same acid as is found in the green liquor; but the ulterior deposit indicates decomposition and the formation of a new salt, colored like that whose destruction has just been operated.

Moreover, as we have already stated, MM. Chevillot and Edwards have shown that mercury, in contact with red camelion, turned the latter green and became oxidised itself, but this reaction is never very clear; there is always formed a considerable precipitate of oxide before the green color is manifested, because a considerable excess of alkali is necessary to its production.

We succeed better by pouring potassa at first into the red camelion, which may be added in very large quantity without perceptibly altering the color, and afterwards putting the mixture into a stoppered flask containing mercury, copper, iron, or any other deoxidising body. The liquor becomes of a very fine green before a considerable quantity of oxide is formed; but if the contact be continued, the green color is destroyed in its turn.

We arrive at the conversion of the red camelion into green camelion more promptly and not less surely by pouring into the former, containing a proper quantity of potassa, a very dilute solution of sulphurous acid.

This reaction presents a very delicate means, and, probably, the best we have, of manifesting the presence of a free alkali in a solution, even when it contains an alkaline carbonate, provided that it does not contain bodies capable of destroying the camelion. With ordinary test papers, indeed, the caustic base, its carbonate and bicarbonate, act in the same manner, and with nearly the same intensity; our process enables us to decide in what state the alkaline matter exists. For that purpose, it is sufficient to drop into the liquor to be tested the quantity of permanganate of potassa strictly necessary for giving it a slight rose tint, and afterwards to add a few drops of an extremely dilute solution of sulphurous acid: if there is any free alkali, the rose tint will be immediately replaced by a green tint; if there is any carbonate or bicarbonate, the rose tint will be slightly altered and turned yellow, and the liquor will become rather turbid.

The carbonate may be distinguished from the bicarbonate by the circumstance that the smallest quantity of caustic alkali added to the liquor will communicate to it the property of turning green with the reagent, if it contains the neutral carbonate, whilst a larger quantity of caustic alkali must be added if it contains bicarbonate.

The liquors which have been filtered or left in contact with the air always contain organic substances capable most frequently of replacing the sulphurous acid, when, however, they are in such small quantity as not to immediately reduce the green camelion itself.

In favorable circumstances, namely, in the absence of reducing substances capable of destroying considerable quantities of camelion, this body might furnish the

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means of estimating free alkali, in a liquor in which the presence of an alkaline carbonate would be opposed to the employment of an acid for the purpose.

Let us suppose, indeed, that the quantity of permanganate of potassa necessary for testing the alkaline liquor does not undergo, on the part of any reducing agents it may contain, any other action than its transformation into green manganate; if we pour into it, by means of a graduated burette, a solution of bicarbonate of potassa of known strength until the red color is reproduced, the quantity of bicarbonate employed will immediately show that of the free alkali, if, however, its nature be known, for half of the acid of the reacting salt will convert the alkali into neutral carbonate. Now, it is only when we approach neutrality that the green camelion turns red; and if we pay attention to the small quantity that operates in the test, it is indubitable that absolute and approximative neutrality cannot in this case be confounded.

By slightly modifying this process, it might be used for the estimation of an alkaline bicarbonate, by means of a solution of caustic alkali of known strength.

In our analytical experiments on manganate of potassa, we confined ourselves to investigating the proportion existing between the elements of the acid; for the impossibility of washing this salt, without decomposing it, prevented us from freeing it from the excess of potassa it contains, and from accurately determining the base.

We estimated the oxygen and the metal in two separate operations: for the oxygen, we employed the same process as served us in the analysis of the hypermanganate, with the sole difference that, on one hand, we dissolved the salt in a weak solution of caustic potassa, in order to avoid its destruction; and that, on the other hand, and subsequently to the first modification, we more powerfully acidulated the arsenious solution.

FIRST EXPERIMENT.

We pounded in a mortar manganate of potassa mixed with potassa, so as to obtain a homogeneous mixture, which was introduced into a glass tube, to carry it on to the balance. We then removed (suddenly, to prevent absorption of moisture) the quantities necessary for the estimation of the metal and the oxygen, namely—

I. 0·943 gr. were dissolved in hydrochloric acid. We obtained from it, with carbonate of soda and calcination of the precipitate which it produced—

Oxide Mn^3O^4	0·694
Corresponding to manganese	0·239
Quantity which, to pass to the state of peroxide, would require oxygen	0·0675

II. 1·025 gr. was dissolved in caustic potassa, so as to form 250cc. of liquor.

It required, of the latter, 31·5cc. to give a rose tint to the arsenious liquor of 2·213 gr. per litre, which makes 0·142 gr. of oxygen which would have been yielded to the arsenious acid, by the 1·025 gr. of salt employed. This quantity, for 0·943 of manganate would therefore be 0·1306 gr., or double that which is found in the protoxide

$$\frac{1306}{943} = 1{\cdot}93$$

SECOND EXPERIMENT.

I. We dissolved, in hydrochloric acid, 1·156 gr. of manganate of potassa still wet with potassa liquor. We obtained from it—

	gr.
Oxide Mn^3O^4	0·405
Corresponding to manganese	0·2916
Retaining, in the state of protoxide of oxygen	0·0843

II. 0·9565 gr. of the same salt were dissolved in potassa; half a pint of solution was formed: it required 32cc. to tinge 50cc. of the arsenious liquor of 2·213 gr. per quart. The 0·9565 gr. of salt yielded 0·14 gr. of oxygen to the arsenious acid. With 1·156 gr., it would have been 1·692 gr., which is nearly double 0·843.

These experiments demonstrate that the acid contains 3 equivalents of oxygen to 1 of metal, since, by means of arsenious acid, we estimate only the oxygen over the first degree of oxidation.

We have endeavoured to verify these results by the estimation and analysis of the oxide which is deposited from the solution of the manganate of potassa in pure water. The estimation was performed by putting into the water an undetermined quantity of salt, passing in a current of carbonic acid, in order to immediately convert the manganate into hypermanganate, washing the oxide, which is deposited, by decantation, and collecting it on a filter, in order to dry and calcine it. On the other hand, the liquors containing the hypermanganate are treated with hydrochloric acid and evaporated to dryness. The residue, re-dissolved in water, is treated with carbonate of soda, and the precipitate obtained is converted into the oxide Mn^3O^4.

In the first experiment, we obtained—

	gr.
From the deposit Mn^3O^4	0·081
From the liquor Mn^3O^4	0·161

In a second experiment, the quantity of metal contained in the red liquor of hyper-

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manganate of potassa was determined by calculating from the quantity of oxygen which this liquor yielded to arsenious acid. As the salt, for 2 equivalents of manganese, contains 8 equivalents of oxygen, of which only 5 can be removed by the arsenious acid, we have, to find the metal, the following proportion:

5 O : 2 Mn or 40 : 56, or else

5 : 7 :: oxygen found : metal required.

1·0615 of manganate of potassa were treated with water, and a current of carbonic acid was passed into the liquor. After having allowed the oxide to deposit, the liquor was decanted, and the first washing waters were added. The succeeding washing waters formed a second liquor, which was estimated separately.

The first present 270cc. in volume; 177 were decolored by 50cc. of arsenious liquor of 10 grs. per quart.

For the 270cc. this would have been—

Oxygen yielded 0·12644 gr.

The second liquor amounted to 250cc., the whole of which it was necessary to employ with 5cc. of the same arsenious liquor.

Or, to be added,—oxygen yielded 0·00808 gr.

Total 0·13452 gr., corresponding to 0·188 of manganese.

The precipitate of binoxide of manganese, submitted to calcination, gave

Oxide Mn^3O^4=0·138 gr. corresponding to manganese....0·090.

Half of the foregoing cypher=0·094 gr.

These results therefore enable us to give the following formula for the transformation of the manganate into hypermanganate and binoxide of manganese:

$$3(KO.MnO^3)+2CO^2=2(KO.CO^2)+KO\,Mn^2O7+MnO^2.$$

The analysis of the oxide deposited from the green camelion was performed by putting this oxide into a small matrass furnished with an S tube and with an abductor tube dipping into a weak solution of caustic potassa. By the S tube, hydrochloric acid is added; and the chlorine disengaged, received into the alkaline liquor, the chlorometric degree of which is determined, serves for making known the excess of oxygen over the first degree of oxidation.

On the other hand, the manganese is extracted from the liquor in the matrass, the liquor is evaporated to dryness, and the residue slightly calcined to render the silica insoluble, re-dissolving in water and heating with carbonate of soda. The precipitate obtained was afterwards converted into oxide Mn^3O^4.

FIRST EXPERIMENT.

1 quart of chlorated alkaline liquor was made; 221cc.5 of it were required for 5cc. of arsenious liquor of 10 grammes per quart.

These 221cc.5 yielded 0·0080808 of oxygen, and consequently 0·0366 of oxygen yielded by the oxide of manganese, experimented on.

From the liquor of the matrass was extracted

	gr.
Oxide	0·154
Corresponding oxide MnO	0·14328
Manganese	0·11114
Oxygen	0·03215

A rather smaller quantity than the foregoing, which is owing, at least partially, to the loss by projection of a small quantity of liquor.

SECOND EXPERIMENT.

The alkaline liquor was diluted so as to raise the bulk to 1 quart. Of this liquor there was required 66cc. to 5cc. of the arsenious liquor of 10 grammes per quart.

Or 0·1224 gr. of oxygen yielded by the whole of the oxide of manganese.

We extracted from the liquor

Oxide Mn^3O^4=0·667, corresponding to 0·62 gr. of protoxide containing 0·139 gr of oxygen.

Which is a little above 0·1224 gr.

In this experiment, as in the first, the difference between the quantities of oxygen corresponding on one hand with the chlorine disengaged, and on the other with the metal supposed to be in the state of protoxide, is not sufficiently great to make the formula of the compound submitted to experiment vary. It is, therefore, binoxide of manganese.

All our analytical results, therefore, only confirm those of M. Mitscherlich.

CONCLUSIONS.

We have employed, in the estimation of the oxygen of the hypermanganates, a more accurate process than M. Mitscherlich used.

New experiments have been performed, to prove the difference of composition of the manganic and hypermanganic acids.

One of them has been turned to account to manifest the presence and perform the estimation of a free alkali in a liquor, even when it contains alkaline carbonate.

Anhydrous hypermanganic acid may be produced, but in small quantity.

ON THE SELENOCYANIDES.*

BY WM. CROOKES, ESQ., ASSISTANT IN THE ROYAL COLLEGE OF CHEMISTRY.

THE remarkable parallelism between sul-

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phur and selenium, which has been traced in so many directions, left but little doubt respecting the existence in the selenium-series of a class of compounds corresponding to the sulyhocyanides. In fact, Berzelius* mentions, that by fusing selenium with ferrocyanide of potassium, a salt may be obtained which possesses the general characters of the sulphocyanide of potassium, but is less stable than the latter compound. This salt, however, appears to have hitherto escaped a closer examination. Berzelius makes no mention that it has ever been analysed, nor have any other selenocyanides been investigated.

This circumstance induced me to re-prepare the potassium-salt, in order to fix its composition by numbers, and to study at the same time several other selenocyanides, in order to establish more fully the character of this class of compounds.

I begin the account of my experiments with a detailed description of both the preparation and analysis of the potassium-salt, which forms the point of departure of the investigation.

SELENOCYANIDE OF POTASSIUM.

This salt was prepared by fusing 1 part of selenium with 3 parts of dry ferrocyanide of potassium in a small German glass retort. The greenish-black deliquescent mass was quickly broken up, and introduced into absolute alcohol. After digesting for a few days, the mixture was filtered; the residue, consisting chiefly of carbide of iron with a little selenide, was well washed with absolute alcohol, and the filtrate subjected to a stream of dry carbonic acid, in order to convert the soluble cyanide of potassium and cyanate of potassa into bicarbonate, which is insoluble in absolute alcohol.†

After filtration, the alcohol was distilled off, together with the hydrocyanic and cyanic acids, and their products of decomposition; the residue, which contained a small quantity of free selenium, was then treated with water, and the extract evaporated over sulphuric acid, *in vacuo*.

Selenocyanide of potassium forms a mass of needle-shaped crystals, much resembling the corresponding sulphocyanide, very deliquescent, and decomposed by almost any acid, with evolution of hydrocyanic acid and precipitation of selenium. It is strongly alkaline to test-paper, and produces great decrease of temperature when dissolved in water. When heated in a close vessel, it fuses, without decomposition, into a clear liquid below a red-heat, solidifying on cooling as a mass of crystalline structure: with access of air, however, it is decomposed a little above 100° C.

The potassium was determined by heating with dilute hydrochloric acid, evaporating the filtrate to dryness, heating to dull redness, and weighing the chloride of potassium produced. The selenium was at first determined by precipitating the solution of the salt with hydrochloric acid; but as this method did not give the whole of the selenium, a portion of it escaping in the form of hydroselenic acid, I afterwards fused the potassium-salt with an excess of nitre, and estimated the selenium as seleniate of baryta.

When heated with dilute hydrochloric acid:

I. 0·3625 grm. of selenocyanide of potassium, dried to 100° C., gave
0·187 ,, ,, chloride of potassium, and
0·198 ,, ,, selenium.

When fused with nitre,

II. 0·4255 grm. of salt gave
0·8276 ,, ,, seleniate of baryta,

which correspond to the following percentages:

	I.	II.
Potassium	27·00	—
Selenium	54·62	54·68

These numbers lead to the formula

$$K\,C^2\,N\,Se^2 = K\,Csey,$$

as may be seen by the following table:

	Theory.		Mean of experiments
1 equiv. of potassium	39·00	27·05	27·00
1 ,, ,, cyanogen	26·00	18·05	—
2 ,, ,, selenium	79·14	54·90	54·75
1 equiv. of K Csey	144·14	100·00	

The formation of selenocyanide of potassium in the fusion of ferrocyanide of potassium with selenium is represented by the following equation:

$$K^2\,Cfy + 4\,Se = 2\,KC^2\,N\,Se^2 + Fe\,C^2 + N.$$

I have examined the residue left in the retort, which, together with undecomposed

* Traité, III, 105.

† In order to ascertain whether the decomposition of the cyanide of potassium by carbonic acid was complete, I dissolved half a gramme of cyanide, containing a little cyanate, in absolute alcohol, and passed a rapid stream of dry carbonic acid through the solution for about an hour. There was an abundant deposit of bicarbonate of potassa, and the filtrate, when evaporated to dryness, left a very slight residue, which entirely disappeared below a red-heat.

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ferrocyanide of potassium, consists chiefly of carbide of iron, retaining only traces of selenium. Berzelius* mentions that the nitrogen evolved during the process is mixed with the vapor of selenide of carbon. The formation of this latter compound must have been evidently due to the action of an excess of selenium upon the residuary carbide of iron, both constituents of which may have been converted into selenides at a high temperature. The gas evolved in my experiments did not contain any biselenide of carbon, at least I did not succeed in condensing any; nor is it likely that this compound could have been formed, as, from reasons of economy, I invariably used a large excess of ferrocyanide of potassium in proportion to the selenium employed.

The above equation requires 1·16 of ferrocyanide of potassium to 1 part of selenium. As stated above, I fused the two substances in the proportion of 3 to 1.

SELENOCYANIDE OF SILVER.

This salt falls down when selenocyanide of potassium is added to a solution of nitrate of silver. Prepared in this manner it resembles chloride of silver in outward appearance. It may be obtained beautifully crystalline, however, by previously adding an excess of ammonia to the silver-solution; in this way it is precipitated in minute crystals, having exactly the appearance of satin. It blackens readily in the light, is insoluble in water, and almost so in ammonia and cold dilute acids; when boiled in strong acids it is immediately decomposed, and unless oxidising acids are employed, selenium is precipitated.

The silver in this salt was determined by heating with hydrochloric acid containing a few drops of nitric acid, and weighing the resulting chloride; the filtrate served to estimate the selenium which was precipitated by sulphurous acid and ammonia.

Treated in this manner

I. 0·3172 grm. of silver-salt dried at 100° C., gave
0·2115 ,, ,, chloride of silver.
II. 0·4464 ,, ,, silver-salt, gave
0·2985 ,, ,, chloride of silver, and
0·1656 ,, ,, selenium,

corresponding to the following percentages:

	I.	II.
Silver	50·18	50·31
Selenium	—	37·09

and leading to the formula

$$Ag\ C^2\ NSe^2 = Ag\ Csey.$$

as the following table shows:

		Theory.		Mean of experiments.
1 equiv. of silver		108·00	50·06	50·24
1 ,, ,, cyanogen		26·00	12·8	—
2 ,, ,, selenium		79·14	37·13	37·09
1 ,, ,, silver-salt		213·14	100·00	

SELENOCYANIDE OF LEAD.

On adding acetate of lead to a solution of selenocyanide of potassium, a lemon-yellow compound is precipitated. It is soluble in boiling water, but is slightly decomposed; the filtered solution, which is neutral to test paper, deposits, on cooling, beautiful lemon colored needles, which are insoluble in alcohol. The salt may be exposed without decomposition, to a temperature of 100° C., but assumes when moist a slight pink tint. The crystals are extremely light.

The lead was determined by heating a portion of the salt in a crucible with strong sulphuric acid, which converts it entirely into sulphate. The carbon was determined in the usual manner.

I. 0·1733 grm. of selenocyanide of lead, dried at 100°, gave
0·125 ,, sulphate of lead.
II. 0·6235 ,, salt, burnt with protoxide of copper, gave
0·1309 ,, carbonic acid.

Centesimally,

	I.	II.
Lead . . .	49·22	—
Carbon . .	—	5·72

The formula

$$Pb\ C^2\ N\ Sc^2 = Pb\ Cscy$$

requires the following values:

	Theory.		Experiment.
1 equiv. of Lead .	103·56	49·62	49·22
2 ,, ,, Selenium	79·14	37·92	—
2 ,, ,, Carbon .	12·00	5·75	5·72
1 ,, ,, Nitrogen	14·30	6·71	—
1 ,, ., Lead-salt	208·70	100·00	

SELENOCYANIDE OF MERCURY WITH PROTOCHLORIDE OF MERCURY.

This beautiful compound is obtained by adding an excess of protochloride of mercury to selenocyanide of potassium; when concentrated solutions are employed, the whole immediately solidifies into a felt-like mass of yellowish crystals; these, when washed with cold water, are purified by crystallisation from alcohol. The crystals of this double salt are sparingly soluble in cold water, rather more so in hot, and very soluble in alcohol and dilute hydrochloric

* Traité, III, 105.

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acid; it does not seem, however, to dissolve in the latter without decomposition, as the solution deposits selenium after standing for some time; nitric and nitrohydrochloric acids dissolve it entirely, the liberated selenium being immediately oxidized. The crystals are anhydrous, and may be heated to 100° C without decomposition; they are decomposed a little above that temperature, intumescing in a remarkable manner.

The mercury was determined by dissolving the salt in hot dilute hydrochloric acid, and precipitating that metal in the filtrate by hydro-sulphuric acid. The chlorine was estimated by dissolving in strong nitric acid, and adding nitrate of silver. I also determined the chlorine and selenium in the same portion by fusing a certain quantity with nitre and carbonate of soda, precipitating the chlorine with nitrate of silver, removing the excess of silver with hydrochloric acid, and precipitating the selenic acid by means of chloride of barium.

I. 0·269 grm. of salt dried at 100° C. yielded
0·1755 ,, ,, protosulphide of mercury.
II. 0·4673 ,, ,, double salt, yielded
0·3173 ,, ,, protosulphide of mercury.
III. 0·5625 ,, ,, salt, gave
0·2364 ,, ,, chloride of silver, and
0·477 ,, ,, seleniate of baryta.
IV. 0·4425 ,, ,, salt, gave
0·1855 ,, ,, chloride of silver.

Percentage,

	I.	II.	III.	IV.
Mercury ..	58·41	58·53	—	—
Chlorine ..	—	—	10·38	10·37
Selenium...	—	—	23·92	—

These numbers lead to the formula

$$Hg\,C^2\,NSe^2\,Hg\,Cl,$$

representing a compound of equal equivalents of selenocyanide of mercury and chloride of mercury, which requires the following values:

		Theory.		Mean of experiments.
2 equiv. of	Mercury..	200·00	58·71	58.47
1 ,, ,,	Cyanogen	26·00	7·64	—
2 ,, ,,	Selenium..	79·14	23·23	23·93
1 ,, ,,	Chlorine..	35·50	10·42	13·38
1 ,,	Double salt..	340·64	100·00	

All my attempts to produce the simple selenocyanide of mercury have hitherto failed. In repeated operations I did not obtain anything except the double compound.

I was curious to ascertain whether sulphocyanide of potassium might exhibit a similar deportment with chloride of mercury. On adding the latter salt in excess to sulphocyanide of potassium, I obtained a voluminous precipitate of needle-shaped crystals, possessing about the same solubility in water, alcohol and dilute hydrochloric acid as the selenocyanide, but I was unable to detect a trace of chlorine in them, either before or after crystallisation from alcohol.

On analysis the following results were obtained:

I. 0·3685 grm. of substance, gave
0·2693 ,, ,, protosulphide of mercury.
II. 0·3877 ,, ,, salt, gave
0·2831 ,, ,, protosulphide of mercury.

Percentage:

	I.	II.
Mercury .	62·99	62·93

The formula

$$Hg\,C^2\,NS^2 = Hg\,Csy.$$

requires the following values:

		Theory.		Mean of experiments.
1 equiv. of	Mercury..	100·00	63·29	62·96
1 ,, ,,	Sulphocyanogen..	58·00	36·71	—
1 ,,	Mercury-salt..	158·00	100·00	

These numbers show that the salt under examination was the simple sulphocyanide of mercury, which has not hitherto been analysed.

Hence sulphocyanide and selenocyanide of potassium exhibit a different behaviour with chloride of mercury.

HYDROSELENOCYANIC ACID.

By suspending finely divided selenocyanide of lead in a warm aqueous solution of the same salt, and subjecting it to a rapid stream of hydrosulphuric acid gas, hydroselenocyanic acid is obtained in solution; the liquid filtered off from the sulphide of lead must be heated to near its boiling-point to expel the excess of hydrosulphuric acid, and again filtered from a small quantity of precipitated selenium. Thus prepared, it is a very acid liquid, easily decomposed by boiling, or exposure to the air; it cannot be concentrated, even over sulphuric acid in vacuo, without decomposition; the addition of almost any acid causes an immediate precipitate of selenium, hydrocyanic acid remaining in solution. It dissolves iron and zinc with evolution of hydrogen, and dis-

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places carbonic acid from the carbonates. All its salts may be formed from it by direct combination.

The free acid existing only in solution, an analysis became impossible; however, the composition of the preceding compounds, and the analogy of hydrosulphocyanic acid warrant the assumption of the formula,

$$H\,C^3\,N\,Se^2 = H\,Csey,$$

and hence we have the following series:

Hydroselenocyanic acid..	H	Csey.
Potassium-salt	K	Csey.
Silver-salt	Ag	Csey.
Lead-salt	Pb	Csey.
Mercury double-salt....	Hg Csey + Hg Cl.	

The following salts I have only examined qualitatively.

SELENOCYANIDE OF SODIUM, prepared by neutralising the free acid, is alkaline, and very soluble; it crystallises in vacuo in small foliated crystals.

SELENOCYANIDE OF AMMONIUM, prepared in the same manner, is deposited in minute needles, very similar to those of the potassium-salt; it is extremely deliquescent.

SELENOCYANIDE OF BARIUM. This salt was obtained by dissolving carbonate of baryta in the acid, and evaporating over sulphuric acid in vacuo. I could not obtain it in any definite crystalline form.

SELENOCYANIDE OF STRONTIUM, obtained like the barium-salt; it crystallises in well-defined prisms.

SELENOCYANIDE OF CALCIUM, obtained in the same manner as the two former, crystallises in groups of stellated needles.

SELENOCYANIDE OF MAGNESIUM dries up into a gummy mass, apparently devoid of crystalline structure.

SELENOCYANIDE OF ZINC. This salt may be obtained either by dissolving the metal or its oxide in hydroselenocyanic acid; it forms groups of prismatic needles, which are not deliquescent.

SELENOCYANIDE OF IRON. Owing to the rapid decomposition of the salts of hydroselenocyanic acid when in contact with stronger acids, I was unable to obtain any coloration with salts of sesquioxide of iron by double decomposition. I was also unsuccessful in preparing it by treating sesquioxide of iron with hydroselenocyanic acid, selenium being immediately precipitated. The salt was, however, once obtained by accident; I was preparing some selenocyanide of potassium by igniting selenium with ferrocyanide of potassium; the result of the fusion was treated with absolute alcohol in a well-closed flask: on filtering off, I found the liquid to have a deep blood-red color, which soon disappeared on exposure to the air, with deposition of selenium. I have not obtained any color at other times, the iron always remaining behind as a black powder, chiefly containing carbide of iron.

SELENOCYANIDE OF COPPER. When selenocyanide of potassium is added to sulphate of copper, a brownish precipitate falls down, which is probably the selenocyanide. I was unable to obtain it in a state fit for analysis, as it rapidly decomposed, even at the common temperature, into black selenide of copper, with separation of hydroselenic acid.

I cannot conclude without acknowledging the great obligation I am under to Professor Hofmann, for placing at my disposal so large a quantity of selenium, and also for his valuable advice and assistance during the progress of these experiments.

ON THE COMPOSITION OF CERTAIN WELL WATERS IN THE NEIGHBOURHOOD OF LONDON, WITH SOME OBSERVATIONS ON THE ACTION OF WATER ON LEAD.*

BY HENRY M. NOAD, ESQ., LECTURER ON CHEMISTRY AT ST. GEORGE'S HOSPITAL.

THE mineral and organic constituents of the waters employed for domestic use in large towns, have lately occupied a considerable share of public attention. It has been justly considered, that the purity of this all-important fluid, must exert great influence on general health. Whether water for drinking should or should not contain any mineral substance, such as lime, is still an undecided question; general experience would, however, seem to indicate, that a certain amount of saline matter is, at all events, not objectionable, since there are no spring waters that do not contain some; but whatever may be thought of the mineral constituents, there can be but one opinion as to the influence of those organic impregnations, so constantly met with in the waters of large towns. In addition to its general unfitness for domestic use, I shall now proceed to show that water containing organic matter, is particularly objectionable, on account of its liability to become conta-

* *Patent Journal.*

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minated with lead, when kept in cisterns of that metal; and that earthy and alkaline sulphates and chlorides, when present in considerable quantity, do not in such waters act as preservatives.

Among the constituents of well waters of large towns, *nitric acid* has often been alluded to. That this acid does occasionally exist in large quantities, is shown by the following analysis by Mr. W. Fisher, of a well water from Highgate.

Saline contents in the imperial pint, by direct estimation, 12·57 grains, consisting of

Silica	0·1120
Sulphate of potassa	2·1306
Sulphate of soda	1·1804
Chloride of sodium	1·2040
Chloride of calcium	0·7390
Nitrate of lime	5·0150
Nitrate of magnesia	2·1331
	12·5231

Attention was directed to this water, firstly, in consequence of its powerful action on the leaden cistern in which it was kept; and secondly, on account of the unusual amount of saline matter which it contained.

Its hardness has prevented its being much used for domestic purposes, which may probably be deemed a fortunate circumstance, as I have found the metal evidently acted upon after being immersed in a bottle of the water for a few days only. From the above analysis it will, I think, appear, that the remarkable action of this water upon lead, is referable to the comparatively small quantities of sulphates and chlorides, and to the extraordinary amount of nitrates it contains.

The source of the latter is pretty clearly indicated by the situation of the well, which is immediately contiguous to the old churchyard, on the very top of Highgate-hill, the loose and sandy soil of which must be teeming with organic substances in all stages of decay, and which, therefore, are constantly furnishing ammonia, from the oxidation of which the nitric acid is, in all probability, derived. In the water, this acid exists in combination with lime and magnesia, which earths would naturally have occurred in the form of carbonates, held in solution by carbonic acid. Not a trace of carbonate now exists, neither does the water contain any appreciable quantity of organic matter, which has been destroyed by the powerful oxidizing operations which are constantly going on in the contiguous soil. I have examined the water from six other wells, at various distances from the yard, but all coming within the range of the Bagshot sand formation: in each of them nitric acid has been detected.

Now, though the presence of earthy nitrates does not communicate any injurious or unwholesome quality to water, it is, nevertheless, important to bear in mind the powerful action of such waters on lead, and the possibility of its becoming the vehicle through which the subtle poison may be introduced into the system. The public, indeed, cannot be too emphatically warned against the too common practice of allowing *any* water, intended for domestic use, to remain stored up in leaden vessels; for, as I shall next show, the existence in the water of considerable quantities of both sulphates and chlorides is not always a security against saturnine impregnations. The following is the analysis of water from a spring at Clapham, which was submitted to me for analysis, in consequence of its strong action on lead:

Silica	0·24
Carbonate of lime	15·09
Carbonate of magnesia	13·97
Sulphate of lime	15·32
Sulphate of potassa	6·79
Sulphate of soda	10·77
Chloride of sodium	11·46
Organic matter	4·10
	77·74

Here, then, we have an instance of a water containing an abundance of so-called "preservative salts," corroding lead with remarkable energy; the bottom of the cistern in which the water was retained having, in the course of six months, been eaten into holes. The oxide of lead could be skimmed from the surface of the water in abundance; but on testing the water beneath, taking care to avoid filtering, by which a very considerable quantity of the metal, even when in solution, may be removed, no signs of lead could be detected. To what are we to ascribe this remarkable action? I believe to the presence in the water of an unusually large quantity of organic matter.

It was during the summer months that the corrosion of the cistern took place so rapidly. The organic matters would then be undergoing the most active decomposition; and, carbonic acid being constantly evolved against the sides and bottom of the cistern, would enter into combination with the *surface*-oxide, and so form carbonate of lead, which is wholly insoluble even in water highly charged with carbonic acid. This is by no means the only instance I have met with, of water abounding in sul-

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phates and chlorides acting strongly on lead; and in every case that I have yet examined, organic matter has been present in unusual quantity.

I wish, lastly, to say a few words on another class of waters which act strongly on lead, viz.:—the *artesian-well waters of the London basin*. These waters are, I believe, always alkaline; those which I have examined are remarkably free from organic matter, and as there is no deficiency of preservative salts; it is to their alkalinity that I am inclined to attribute the corrosive action which they exert on this metal.

ON DR. GREGORY'S SULPHURET OF NITROGEN, AND ON THE VARIETY OF SULPHUR INSOLUBLE IN SULPHURET OF CARBON.*

BY MM. FORDOS AND GELIS.

In several Treatises on Chemistry, and particularly in Graham's 'Manual of Chemistry' there is a compound described by the name of Gregory's sulphuret of nitrogen, which is said to be formed of 12 equivs. sulphur and 1 of nitrogen. We have attempted to reproduce this singular substance, but the results obtained have led us not to admit its existence. We nevertheless followed the directions of Dr. Gregory. We treated the chloride of sulphur with liquid ammonia; and after having observed all the peculiarities which accompany the reaction, and which have been described with the greatest care by M. Soubeiran, we obtained a yellow substance, possessing all the characters assigned by Dr. Gregory to the sulpuret of nitrogen, and especially that of furnishing an amethyst-red liquor when treated with alcohol containing a little potassa. This coloration however quickly disappears.

As this property likewise belongs to a mixture of sulphuret of nitrogen and sulphur, it appeared probable that it was due to these two substances; and we had recourse to sulphuret of carbon to ascertain their presence. This liquid dissolved the greater portion of the mass. On evaporating the solution, it left a residue consisting of numerous octahedra of sulphur, coated with a small quantity of the ordinary sulphuret of nitrogen, and in some cases with traces of a golden yellow substance, sparingly soluble in sulphuret of carbon, and which proved to be a compound of chloride of sulphur with sulphuret of nitrogen. Whenever this happened, the residue required to be frequently treated with sulphuret of carbon in order to exhaust it; and the property of being colored amethyst-red by an alcoholic solution of potassa persisted for a long time; for the combination in question possesses this property, as well as the mixture of sulphur and sulphuret of nitrogen.

The residue insoluble in the sulphuret of carbon was dried, then reduced to powder and washed with hot distilled water, in order to remove a small quantity of murfate of amonia which it still contained. We then found by analysis that it contained no nitrogen, water, hydrogen or chlorine; it then occurred to us that it might be an oxide of sulphur. To test the accuracy of this hypothesis, we treated a certain quantity of the substance with fuming nitric acid, in order to estimate the sulphur; the weight of the sulphate of baryta obtained showed that it consisted entirely of sulphur. But we have stated above that it was insoluble in sulphuret of carbon; it was therefore not ordinary, but a modified sulphur, analogous to the amorphous modification of phosphorous examined by M. Schrœtte.

In 1848, M. Deville published in connexion with several important observations on sulphur, the remarkable fact, that the sulphur which has undergone sudden cooling, as in the flowers of sulphur and melted sulphur, leaves, when treated with sulphuret of carbon, an appreciable residue, varying from 0·11 to 0 35 of the primitive weight. It was evident that the insoluble sulphur which we had found in trying to prepare Dr. Gregory's sulphuret of nitrogen, was the sulphur discovered by M. Deville in the flowers of sulphur and the soft sulphur. M. Deville however attributes this modification of the sulphur to sudden cooling; but this explanation, which applied to the peculiar circumstances under which he observed it, cannot be admitted in the case we have described, as no heat was employed.

This production, by the humid way, of modified sulphur insoluble in sulphuret of carbon, led us to think it might be obtained under other circumstances; and we soon found that it occurs in very large quantity in the deposit produced by treating the chlorides of sulphur with water. This result clearly proves that in Dr. Gregory's experiment the ammonia merely gives rise to various compounds, which mix with the sulphur and alter its properties.

We have also met with this modification of sulphur in the deposit resulting from the action of hydrochloric acid upon solutions of the hyposulphate, and likewise in consi-

* *Comptes Rendus*, March 17, 1851.

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derable quantity in the precipitate produced by the action of sulphurous upon hydrosulphuric acid in the presence of water. The sulphur obtained by treating the polysulphurets with acids contains but a trace. The crystallized native sulphur, that which is deposited by sulphureous springs, &c., and that arising from the slow oxidation of a solution of sulphureted hydrogen, are, on the contrary, soluble without residue in sulphuret of carbon.

Whenever chemists have detected the production of various isomeric states of sulphur, they have always been obtained by the action of heat; and no one had previously indicated the possibility of the formation of one of these modifications under water.

The variety of sulphur insoluble in sulphuret of carbon is likewise so in water, alcohol and æther; it may be boiled in distilled water for a long time without losing its property. When heated in an oil-bath to about 220° in a glass tube in which has been placed for comparison a piece of ordinary sulphur, it remains solid for some time after the ordinary sulphur has melted; but if the temperature be maintained between 220° and 248°, it is gradually modified, and fuses, and now dissolves without residue in sulphuret of carbon.

ON AN OXIDE OF TIN FOUND IN THE COPPER FURNACES.*

BY MR. JOHN CAMERON, F.C.S.

In the Number for October 1, 1849, of the 'Chemical Gazette,' there appeared a paper by M. Daubrée "On the Artifical Production of a crystallized Oxide of Tin," by passing the vapor of water and perchloride of tin through a porcelain tube heated to redness. The product, according to the account given in that paper of his experiment, was a crystalline stannic acid, the specific gravity of which he gave as 6·72, and the crystalline form a right rhombic prism. Some time previous to the appearance of the paper in the 'Chemical Gazette,' I had observed a crystalline substance in the slags of the copper furnaces at certain stages of the process, which on examination I found to be a compound of tin; and when I read the account of the artificial production of a crystallised stannic acid, I concluded that they were one and the same, as they were produced under similar circumstances. I collected a quantity of the crystals, and digested them in nitric acid for a considerable time, to free them from adhering oxide of copper; after which I mixed them intimately with a reducing flux consisting of carbonate of soda and black flux, and submitted the mixture to a white heat in the common Cornish crucible, by which means I obtained a button of metallic tin.

Shortly after I had found the crystals to be a compound of tin, the paper of M. Daubrée appeared in the 'Chemical Gazette,' and I believed at the time that they were the same. Recently however I took the specific gravity of the crystals that I observed, and found it by experiment to be by

		Mean.
First experiment....	3·04	2·8373
Second experiment..	2·8345	

From this it would appear that the oxide formed in the copper furnaces is not the same as that described by M. Daubrée, the specific gravity of which is more than twice the sum of that which I have found. On examination, I found the form of the crystals quadrilateral prismatic, and possessing a vitreous lustre. These crystals are not changed when submitted alone to a white heat, and are perfectly insoluble in nitric, sulphuric and hydrochloric acids, and scarcely anything dissolved by *aqua regia* from them. Heated in a test-tube in contact with phosphorus, potassium and sodium, they are decomposed, and globules of metallic tin deposited in the bottom of the tube. In order to satisfy myself that it was an oxide, I reduced some of the crystals to a very fine powder, in an agate mortar, and placed it in a tube containing chloride of calcium, and to the other end I attached an empty glass tube with a bulb at one end of it. A current of hydrogen was then passed through the chloride of calcium over the powdered crystals, and a spirit-lamp at the same time applied to the tube containing the oxide till it was heated to redness. It soon began to darken in color, and shortly after globules of tin appeared on the surface of the powder, and a quantity of water was deposited in the bulb of the tube attached. From one analysis which I have made of this compound, it would appear to be a quadroxide of tin, SnO^4; but as the ascertaining its exact composition will require some further research, I reserve that for a future communication.

Spitty Copper Works,
Llanelly,
March 20.

* *Chemical Gazette*, April 1, 1851.

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ON THE SPHEROIDAL STATE OF BODIES.*

BY E. N. HORSFORD, RUMFORD PROFESSOR IN HARVARD UNIVERSITY, CAMBRIDGE, AMERICA.

THE early observations of Leidenfrost, and the later and more extended researches of Boutigny on the so-called spheroidal state of bodies, have caused much attention to be directed to the interesting phænomena considered under this name, and to the speculation, that a new law, superseding the ordinary laws of heat, was here illustrated.

The object of this communication will be to show that these phænomena are not rare, and that they require no new law for their explanation.

In the experiment of dropping water upon a hot polished metallic surface, as into a hot platinum crucible, we have three bodies concerned in the phænomena that follows, viz. the supporting surface, the water, and layer of water interposed between them. The water rests upon a cushion of steam, continuously evolved by heat from the water, and assumes rounded margins as a result of the gravity of its particles towards its own centre. Its condition approximates to that of a liquid entirely surrounded by a uniformly-elastic medium, as, for example, a drop of molten lead in air, and permits a proportionate approximation to the spherical form.

It is essential only that there be two bodies, one of them being fluid, between which affinity is wanting.

Corresponding with water in the ordinary experiment, called by the name of Liedenfrost, æther, alcohol, turpentine, a great variety of essential oils, and many other liquid bodies, may be employed. The conditions are the same. The liquid evolves a vapour, which, constantly issuing, prevents contact with the supporting surface. Here are three bodies and a high temperature.

Æther and oil dropped on water assume the spheroidal state. They have no affinity for the water. Here but two bodies and no heat are required. Quicksilver poured upon glass assumes the spheroidal state. It has no affinity for the glass. Here but two bodies are concerned. Water dropped upon glass strewn with charcoal dust or fine powder, like pollen, takes on the spheroidal state. Potassium and sodium thrown upon water assume this state. In the decomposition of the water producing potash, hydrogen keeps the floating sphere and water apart. The dew-drop presents a spheroidic state. It rests in most cases upon the hairs or down with which leaves are covered, and is not in contact with the leaves or twigs.

The bead, as it is called, which appears at the surface of some liquids when violently shaken, and of which we have a familiar example on the water around the prow of an advancing sail-boat, is an instance of the spheroidal state of great interest. What prevents the prompt reunion of the bead with the mass is not so obvious.

There is a fact in the history of the barometer which permits attention, and which may have influence in explaining this phænomenon. When pure merch has been introduced into a barometric tube, and thereafter boiled, so as to expel all the air, upon erecting the tube in the cistern, the top of the column presents a certain curve, the meniscus, the character of which is dependent on the composition of the glass and diameter of the tube. If now a bubble of air be introduced, and then removed by carefully causing the mercury to sweep up and down the length of the tube, upon erecting the barometer the mercury will stand at the same elevation as before, but the meniscus will be less convex. Here, as in the case of the bead, it may be conceived that the mercury and water have condensed an infinitely thin layer of air upon their surfaces, which provide for the phænomena of the spheroidal state in the latter instance, and which modify the affinity of the mercury for the glass in the former*.

Of this class of facts, to none has more interest attached than to the recent experiments of Boutigny with molten metals. To him are we indebted for the first scientific consideration of this subject, although it appears that jugglers performed the feat of washing the hands in molten lead many years ago. Eleven years ago the author witnessed an explosion from the contact of molten slag with water, which expended most of its force upon the face and breast of a workman near. The shock prostrated and bruised, but did not burn him.

One form of the experiment is given in the adjustment of the wick of a burning spirit-lamp with the fingers, which is every day practised by chemists.

In the experiment of passing the hand into molten iron which has been repeatedly performed by the author without discomfort, it is necessary only, as has been noticed by Boutigny and others, that the surface of

* Read before the American Academy.

* The condensation of gases upon the surfaces of solids is a familiar fact, of which the ignition of a jet of hydrogen by platinum-sponge is a well-known illustration.

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the skin be wet, or covered with some body like powdered resin, which upon the application of heat will readily vaporize. That the experiment may be safely performed, any one may satisfy himself by passing through the molten mass any highly-combustible substance previously moistened, as for example a stick of sealing-wax. When the hand, previously moistened, is passed into the liquid metal, the water is vaporized, interposing between the metal and the skin a sheath of vapor. In its conversion into vapor the water absorbs heat, and this still further protects the skin. It was thus in the case of the workman alluded to above. His face was streaming with perspiration, and the molten slag came in contact, not with the skin, but with the layer of vapor which rose upon its surface as the heated mass came near.

The explanation of Berzelius, offered some years since, and confirmed by all the experiments, so far as I know, that have been performed is the following:—

In the Leidenfrost experiment, a layer of vapor continuously evolved from the inferior surface of the liquid, provides an aëriform medium which does not conduct heat, but merely transmits radiant heat, which, passing through the liquid, as through most transparent substances, heats it but slightly. Thus evaporation is slow. The temperature of the liquid, it is well known, remains constantly below that of the boiling-point. This accounts for the much greater length of time required for water to evaporate when resting upon an oiled surface than when in contact with wood or metal; and for the length of time that dew-drops on spiders' webs will sustain exposure to the sun, when compared with that which would be required to evaporate an equal quantity of water from a surface where there is actual contact over a considerable area, and where conduction may take place.

The explosions sometimes following the first contact of a piece of potassium or sodium with water are due to the admixture of evolved hydrogen and atmospheric air. The explosion at the conclusion of the burning of the potassium or sodium is of another character. It is due to the sudden contact of the hydrate of potash when the temperature has become sufficiently low to permit it, and is analogous to the phænomenon witnessed when the surface supporting a mass of water in the spheroidal state is permitted to cool down until contact takes place.

The explosions occasionally witnessed where a large quantity of fused saltpetre has come in contact with water, are of this description.

The explosions of steam-boilers have recently, in several instances, been ascribed to the properties of steam evolved from water in the spheroidal state, or evolved at the instant contact between the water and boiler is resumed. This is called a highly explosive steam. Not an experiment has been made, of which the author is aware, going to show any difference between this and ordinary steam. It is conceived, that, in some way, the mass of water in a boiler becomes separated from the interior surface of the metal, as in the experiment of Leidenfrost; and that upon cooling down to about 280° to 300° F. contact is resumed, and from the sudden evolution of steam, explosion results. But boilers of ordinary strength would sustain any pressure which could be exerted from steam, produced within its own walls at a temperature of 300° F.; and by the conditions supposed, the water in the boiler has been already more highly heated; else it could not have been *cooled down* to this temperature. A higher heat must have subjected the boiler to greater pressure, and yet that increased pressure had been sustained.

EXAMINATION OF SOME CANADIAN MINERALS.*

BY T. S. HUNT,

CHEMIST AND MINERALOGIST TO THE GEOLOGICAL SURVEY OF CANADA.

THE science of mineralogy in this province has been greatly indebted to the labors of Dr. Holmes of Montreal, and Dr. Wilson of Perth, who have devoted much time in exploring and bringing into notice many interesting mineral species. Among collections of those which were sent to Dr. Thomson of Glasgow, that gentleman recognized several specimens which he described as new species, but, owing to an unfortunate want of accuracy in his mineralogical descriptions, their identification has been difficult, and mineralogical writers have been unwilling to admit their claims to the rank of distinct species. Having, through the kindness of the two gentlemen first named, been put in possession of well-authenticated specimens of the minerals in question, I have submitted them to careful analysis and have obtained the subjoined results.

FELSPARS.—The first one of this genus which I shall notice is the mineral described by Dr. Thomson, under the name of Perthite.† It is found in the township of

* *Philosophical Magazine.*

† *Phil. Mag.* 1843, xxii. p. 189.

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Bathurst, and mixed with quartz, forms an Earite rock in which large cleavable masses of the felspar are occasionally met with. Form, apparently monoclinic. Hardness 6 (scale of Mohs.) Specific gravity 2·576-2·579. Of a darker colored fragment 2·583. Lustre vitreous, inclining to pearly; color light flesh-red, alternating with reddish or pinchbeck brown, the two colors forming bands from half a line to a line in width, coincident with one of the planes T, often however interrupted and intermingled one with another. The darker bands on the cleavage surface T exhibit, when viewed perpendicularly, a golden reflexion like the variety known as *aventurine felspar*. The colors of the mineral become much darker on exposure to the action of the weather. The results which follow were obtained from freshly-broken light-colored fragments, and the mineral reduced to a fine powder by elutriation, was dried in one analysis at 300° F., and in another at the ordinary temperature over sulphuric acid. The earthy constituents were determined in the ordinary manner after fusion with carbonate of soda, and the alkalies by decomposing the mineral by the aid of fluor spar and sulphuric acid.

	I.	II.
Silica	66·44	66·50
Alumina	18·35	19·25
Peroxide of iron	1·00	
Lime	·67	·56
Magnesia	·24	·24
Potassa	6·37	6·18
Soda	5·56	5·56
Water (loss on ignition)	·40	·44
	99·03	98·73

It is evident from these analyses, that the composition of the mineral is precisely that of orthoclase, to which species it had already been provisionally referred by Shepard,‡ Dana,§ and myself.‖ The proportion of soda is larger than is generally met with in this species; but Domeyko found 4 per cent. of this alkali in an orthoclase from Chili, and Schnederman 10 per cent. in one from Vesuvius, while various other specimens have afforded 2 and 3 per cent.¶

The second species to be mentioned is that described by Dr. Thomson under the name of Peristerite,* in allusion to the beautiful play of colors, resembling that of Labradorite, which it exhibits.

The specimens furnished me by Dr. Wilson as duplicates of those sent to Dr. Thomson, are composed of a mixture of quartz grains readily distinguishable by their lustre, greater hardness and want of cleavage, disseminated through a felspar, which still so far predominates as to give distinct cleavages to the mass. Specimens furnished me from the same locality exhibited the mineral in fine cleavable masses free from quartz, occasionally passing into the variety just described.

Form triclinic; the cleavage forms gave apparently the angles of those of albite, but did not admit of accurate measurement. Cleavage perfect parallel with P and M, less distinct with T. The surface P shows a fine play of colors like Labradorite, in which a delicate cerulean blue predominates, occasionally passing into light green and yellow. The face M is often marked with striæ parallel to P. The same play of colors and striation on alternate surfaces are distinguishable in the masses mixed with quartz.

Hardness 6. Specific gravity 2·625-2·627. Lustre vitreous, inclining to pearly on P. Color white passing into pearl-gray and reddish white, or flesh-red in the quartzose specimens; translucent, fracture uneven. Before the blowpipe very difficultly fusible, colors the flame strongly yellow; the analysis of a pure specimen gave..

	I.	II.
Silica	66·80	67·25
Alumina	21·80	
Soda	7·00	
Potassa	·58	
Lime	2·52	2·03
Magnesia	·20	
Peroxide of iron	·30	
Loss by ignition	·60	.66
	99·80	

The results of these analyses, conjoined with its other characters, show this mineral to be an *albite*. The purity of the silica obtained was verified by subsequent examination, and it may be remarked that in the first analysis the small portion of silica adhering to the alumina was not separated. Thomson's analysis gives a much larger portion of silica, but it is evident, from the description which he has given, that he analysed the quartzose aggregate.

Shepard and Dana have referred the mineral to orthoclase; and Dana, in his last edition, by a mistake says that I have confirmed the opinion, whereas I had only alluded to the apparently oblique rhomboidal form of its cleavage, conjoined with the beautiful opalescence, and its resem-

* *Phil. Mag.* 1843, xxii. p. 189.
‡ See his "System," &c., p. 134, 2nd ed.
§ *Dana's Mineralogy*, ed. 1844, p. 351.
‖ *Annual Report of Geological Survey*, 1847-48, p. 135.
¶ See *Dana*, 3rd edition, p. 326.

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blance to the Fredericksvärn opalescent felspar, which has erroneously been referred to that species, as leading to the supposition that it was Labradorite.

BYTOWNITE.

This species of Dr. Thomson, founded upon specimens from a boulder found in the vicinity of Bytown,* has been referred to a number of species. Shepard includes it under pyroxene,† and Dana, in his edition of 1844, refers it to scapolite, while in the last edition of his Mineralogy he seems to regard it as more nearly allied to Barsowite.‡ The specimen which Dr. Holmes kindly placed in my hands was from a fragment which had been pronounced by Dr. Thomson to be the species described by him as Bytownite.

It is massive, granular, strongly coherent, and, with the exception of occasional disseminated portions of black hornblende, is quite homogeneous; the grains exhibit one perfect cleavage, and indications of another oblique to it, which is less apparent. Hardness about 6·5. Specific gravity 2·732-2·733. Lustre vitreous, approaching to pearly upon the cleavage faces; translucent; color greenish white. The analysis was performed upon carefully selected grains, and the pulverized mineral first dried at 212° F. was afterwards exposed over the surface of sulphuric acid. It gave—

Silica	47·40	47·30
Alumina	30·45	
Lime	14·24	
Magnesia	·87	
Protoxide of iron	·80	
Soda	2·82	
Potassa	·38	
Water	2·00	1·80
	98·96	

The water in this mineral seems to be chemically combined. Thomson in his analysis gives the same amount of silica and water as above, but for the rest differs greatly as to the proportions of lime and alkali. Its composition distinguishes it at once from pyroxene, while from scapolite it differs in its greater hardness and its cleavage; from these latter characteristics, as well as from its chemical composition, it must I think be regarded as *anorthite*.

The mineral from the vicinity of Perth, which has been generally circulated among mineralogists under the name of Bytownite, is finely granular, almost compact, and has a smoky-blue color, with a hardness of about 6, and a specific gravity of 2·739. When viewed under a magnifier, it is seen to be a mixture of a light-colored translucent granular mineral, apparently like the preceding, exhibiting cleavages with a vitreous lustre, and intermixed with minute grains of what appears to be black hornblende. The present specimens exhibit such a mixture that its analysis would be valueless.

LABRADORITE.

This species is common in boulders in the vicinity of the crystalline rocks of the province, from Labrador to Canada West, but has not yet been found in place. In Drummond C.W., large masses of the mineral are met with, some portions of which exhibit a play of colors equal to that of Labrador. The fragment from this locality, submitted to analysis, had a specific gravity of 2·697. Color lavender-blue with a pearl-gray opalescence; it gave—

Silica	54·70
Alumina	29·80
Lime	11·42
Peroxide of iron	·36
Magnesia	trace
Soda	2·44
Potassa	.23
Water	·40
	99·35

From the invariable loss on ignition, even when every precaution has been observed in the desiccation of the minerals, I am inclined to believe with Delesse and Laurent, that these small quantities of water so generally met with in the felspars are not hygroscopic, but belong to the chemical composition of the minerals themselves.

RAPHILITE.

This species was instituted some years since by Dr. Thomson from specimens from Lanarck C.W., sent him by Dr. Holmes of Montreal, and is, according to his analysis, an anhydrous silicate of lime, magnesia, alumina and protoxide of iron, with more than 10 per cent. of potassa.* Dana, in the first edition of his Mineralogy, suggested that it might be a fibrous hornblende analogous to Arfvedsonite, to which species Shepard also refers it; while in his last edition, Dana, in conformity with the suggestion contained in my report for 1847-48, regards it as tremolite. Being furnished with undoubted specimens of the mineral, I

* See Dr. Thomson's *Outlines*, &c., vol. i. p. 372.

† *Mineralogy*, Ed. 1844, p. 137.

‡ Ed. 1844, p. 523; and Ed. 1853, p. 342.

* *Outlines*, vol. i. p. 152.

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have submitted it to a careful examination, the result of which confirms this opinion.

It occurs in delicate fibrous masses slightly divergent, and often several inches in length; the fibres are readily separable, brittle, and somewhat elastic. Hardness 5·5. Thomson gives 3·75, but the fibres scratch deeply the surface of a crystal of apatite. Specific gravity in powder 2·845 (2.850 Thomson). Lustre vitreous silky; color grayish or greenish white, becoming reddish on weathered surfaces; translucent. Analysis failed to detect more than very small portions of alkalies, and gave—

			Oxygen ratio.
Silica	55·30		28·7182=2
Lime	13·36	3·7991	
Magnesia	22·50	8·7162	
Protoxide of iron	6·30	1·3982	
Alumina	·40	·1860	
Manganese	traces.		
Potassa	·25	·0424	
Soda	·80	·2064	
Loss on ignition	·30	....	14·3492=1
	99·31		

The mineral has thus a composition entirely different from that before assigned to it, and from the ratio between the oxygen of the silica and the protoxides, evidently pertains to the type $Si^4O^6(M^4)$ of Gerhardt, to which the horoblendes are by him referred. This formula, corresponding to $2SiO^3$, 3MO in the Berzelian notation, better represents the composition of this species than the formula of Rammelsberg, R^4Si^3 or $Si^9M^8O^{13}$.

SERPENTINES.

The species described some years since by Dr. Thomson under the name of Retinalite,* was founded upon a specimen of serpentine sent him by Dr. Holmes, from the vicinity of Grenville in this province. According to his analysis, it was a hydrated silicate of magnesia and soda, containing silica 40·55, magnesia 18·856, soda 18·832, peroxide of iron and alumina ·920, and water 20·000. This composition in a mineral having the sensible characters of serpentine seemed anomalous, and I was therefore desirous of submitting it to further examination. Dr. Holmes had still in his possession a portion broken from the specimen which he sent to Dr. Thomson, and this he kindly placed in my hands. I have also specimens collected by myself at the original locality. It there fills seams, or is diffused through a white crystalline limestone in the vicinity of a dyke or trap, and is most abundant nearest the intrusive rock. It is massive, without any trace of crystallization, and has a hardness of about 3·5 (3·75 Thomson). Specific gravity 2·434-2·525 (2·493 Thomson). Other specimens of an olive-green color gave 2·476. Lustre resinous, shining, streak white, color honey-yellow passing into oil-green and olive-green, translucent, fracture conchoidal.

The first analysis is from the original specimen, which was honey-yellow, the second from another specimen of an oil-green. The pulverized mineral was dried over sulphuric acid.

	I.	II.
Silica	39·34	40·10
Magnesia	43·02	41·65
Peroxide of iron	1·80	1·90
Soda	traces.	·90
Water	15·09	15·00
	99·25	99·55

Another serpentine closely resembling the retinalite, which is found in nodular masses with a calcareous nucleus, imbedded in limestone at the Grand Columet Island, has a specific gravity of 2·362-2·381, and a pale wax yellow color. Its analysis afforded me—

Silica	41·20
Magnesia	43·52
Peroxide of iron	·80
Water	15·40
	100·92

These specimens, although the latter differ somewhat from the others in specific gravity, are nearly identical in composition with each other and with the marmolite of Hermann, but differ from that in not being foliated. The proportion of water which they contain is intermediate between that of serpentine and of the Deweylite of Emmons, from which latter they are separated by their higher specific gravity. Dana has, however, in consideration of the wide latitude presented in the composition of this class of minerals, united marmolite with serpentine, and it would not, we think, be advisable to retain retinalite, which is only a compact marmolite, as a distinct species.

The presence of traces of alkali has not hitherto been generally recognised in this class of minerals, but Ficinus has observed from ·50 to 1·33 per cent. of soda in the dermatine of Breithaupt, and Schmidt 1·98 per cent. in an asbestiform serpentine from Zöblitz.*

* *Outlines*, &c., vol. i. p. 201.

* *Dana's Mineralogy*, ed. 1850, pp. 257, 602.

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ZIRCON.

This species is found in considerable abundance at Grenville, associated with tabular spar, calc-spar, sphene, pyroxene and plumbago. The crystals are often half an inch in diameter and an inch or more in length, with finely modified terminations. Specific gravity 4·602–4·625; color brownish red, passing into flesh-red and cherry-red. Its analysis afforded me—

Silica	33·7
Zirconia	67·3
	101·0

The zirconia contained a trace of oxide of iron, which was not separated.

There are still among the known minerals of the province, some imperfectly described species which I purpose to examine, and my results may probably form the subject of another communication.

Montreal, Feb. 7, 1851.

ON THE EXTRACTION OF OXYGEN FROM ATMOSPHERIC AIR.*

BY M. BOUSSINGAULT.

(*Concluded from page* 312.)

FROM the commencement of these researches it was observed that baryta, after having been heated for a long time, ultimately underwent a perceptible contraction. Sometimes it even seemed vitrified, and, on one occasion, when the expulsion of the oxygen took place at a strong white heat, it underwent a pasty fusion. On the other hand, in dissolving in nitric acid baryta which had been used in the experiments, a very large proportion of silica was collected as a residue. This is because baryta, as it is ordinarily obtained, is united to considerable proportions of silica and alumina. M. Thenard was the first who made the remark, and he attributes the presence of these bodies to the porcelain crucibles or retorts in which the nitrate is made to undergo a lengthened calcination. By operating the calcination in a platinum vessel or, as I have reason to believe, in an iron vessel, baryta is procured free from silica and alumina, and not *fritting* by the action of heat if it be protected from the contact of earthy matters, and which it seems should serve indefinitely for extracting oxygen from atmospheric air.

The following, for example, is a series of oxidations operated by a current of air acting on pure baryta: the numbers relate to 25 grammes of matter. We extracted:

	Litres.	Temp.	Bar.
After first oxidation	Oxygen 1·70	59° F.	Millim. 759
After second oxidation	" 1·79	62°	" "
After third oxidation	" 1·82	57°	" "
After fourth oxidation	" 1·74	63°	" "
After fifth oxidation	" 1·74	66°	" "
After sixth oxidation	" 1·64	66°	" "
After ninth oxidation	" 1·68	67°	" "
After tenth oxidation	" 1·72	66°	" "
After eleventh oxidation	" 1·75	66°	" "

Although it was proved that the weakening of the absorbing faculty of baryta for oxygen did not arise from the intervention of aqueous vapor or carbonic acid gas which the air might retain, I am nevertheless preoccupied with the effect which the vapor and this gas would exercise if unpurified air accidentally entered the apparatus. The experiments made in this respect were encouraging; they gave however, unexpected results.

We passed over 2·595 gr. of baryta, placed in a platinum boat a current of air not deprived of its carbonic acid or moisture; the air passed slowly, the tube was heated to dull redness, and the oxygen was received in a graduated receiver placed over mercury. Each oxidation lasted from a quarter of an hour to half an hour. We extracted:

	Cubic centim.	Temp.	Bar.
After first oxidation	159 oxygen	57° F.	Millim. 769
After second oxidation	158 "	59°	" "
After ninth oxidation	162 "	64°	" "
After tenth oxidation	157 "	64°	" "

In this experiment the weight of the baryta was only augmented 0·067. However, 50 litres of air taken in the laboratory at the temperature of 53 to 55° F., had been passed into the tube. This air must have contained 0·040 gr. of carbonic acid, and, if it had been saturated with vapor, it would have to bring nearly 0.5 of water. It is therefore probable that the baryta did not take, in this case, all that it might have taken, of either water or carbonic acid. However, this alkali has, for both of these substances, a very powerful affinity; I have seen, for example, that at dull red heat it absorbs carbonic acid gas. Its affinity for water is not less powerful; the hydrate fused at a white red heat without being decomposed. Nevertheless, the experiment shows that carbonate of baryta, maintained at a cherry-red heat in a platinum boat placed in a porcelain tube traversed by a rapid current of dry air gives off, slowly, but certainly, a portion of carbonic acid; at a white heat, the decomposition proceeds with greater rapidity; but still it would take a very considerable time to completely decompose it.

In the same conditions, the hydrate is

* *Comptes Rendus.*

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promptly decomposed, and if we conclude the operation by heating above cherry-red, in order to destroy the binoxide formed, caustic baryta is obtained; all the water of the hydrate is eliminated by the current of dry air. These facts explain why undried air, when it contains only a few ten-thousandths of carbonic acid, did not immediately weaken the absorbent power of the baryta.

The process which I have just made known allows of separating oxygen, without too much difficulty, from the nitrogen with which it is mixed in atmospheric air; and, whilst confining myself to presenting it as a simple laboratory experiment, I cannot help adducing some numbers which will probably give it an interest of another order. Thus, I may mention that 10 kilogrammes of baryta, in becoming completely oxidised, can take up and afterwards give up 730 quarts of oxygen gas; this is the cypher indicated by theory; but, for the celerity of the operation, so far at least as I am at present able to judge, we can reckon on only 600 quarts. Within this limit, and in acting on 100 kilogrammes of matter divided into 8 or 10 cylinders fitted into a furnace, we should disengage, at each deoxidation, 6000 quarts of oxygen gas, and, as, probably 4 or 5 operations would be performed in 24 hours, such a system would furnish from 24,000 to 30,000 quarts of gas per diem.

The employment of baryta would not now present serious obstacles: this alkali is prepared by thousands of kilogrs. in consequence of M. Dubrunfraut's sugar prrocess. But it would be necessary, in a practical point of view, to undertake a series of investigations. For example, it would be requisite to examine what is the influence of the force of the current of air on the oxidation, and if it were not convenient, in order to increase this force, to oxidise the baryta with hot air. With regard to this, I can only present conjectures deduced from trials made on too small a scale, and I have entered into these details only because I have thought that by explaining the results of carefully performed experiments, it will be easy to make applications of them.

ON THE ACTION OF CHLORINE ON THE INSOLUBLE IODIDES.*

BY SIGNORE GIOVANNI RUSPINI.

Thenard, Lassaigne, Regnault, Roux, and many others, have long since demonstrated that the iodides in solution, treated by chlorine, are decomposed, re-dissolving in an excess of the reagent, because a colorless chloride of iodine is formed, or else on account of the decomposition of the water which gives rise, according to Regnault, to hydrochloric and iodic acids.

Some chemists have also remarked that chlorine, at a high temperature, is capable of decomposing the insoluble iodides. But no one, so far as I know, has hitherto examined what takes place when we put chlorated water in presence, even without immediate contact, and without heat, with the insoluble iodides. Having had an opportunity of studying this action, I am about to explain here, very succinctly, what is produced in such circumstances.

As soon as a flask containing a solution of chlorine is brought near to an insoluble iodide, the iodine is set free, as may be perceived from its color, and better still by the aid of a small quantity of starch, which it immediately converts into perfectly characterized blue iodide of starch. It is possible that this mode of separating iodine from the insoluble iodides may become useful in many circumstances, in which the too small quantity of iodide at disposal would admit of no other kind of analysis. The iodides of silver, lead and mercury, placed in a porcelain capsule, and brought near to a flask of chlorated water, may immediately present the phenomenon of decomposition which I have just mentioned, and thus enable us to distinguish them very readily from bodies which might resemble them in other respects.

We see, from this example, how reagents may acquire power when they are employed in circumstances which prove their action, whilst, on the contrary, when they are used in a different manner, they may act very badly, and even exert no appreciable action.

ON THE DEGREE OF SENSIBILITY OF SEVERAL REAGENTS FOR IODINE AND ITS VARIOUS COMPOUNDS.*

BY J. L. LASSAIGNE.

Since the presence of iodine has been detected in a great number of mineral and organic products, the most delicate reactions for demonstrating the smallest traces of this metalloid have been sought for. Although the sensibility of starch is very great, as was long since proved by the experiments of

* *Journal de Chimie Médicale*, April, 1851.

* *Journal de Chimie Médicale*, March, 1851.

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Stromeyer, confirmed by my own in 1832, we have recently seen chloroform* pointed out as capable of being advantageously placed beside starch for detecting, not only traces of iodine, but for approximatively estimating this body in a certain number of organic bodies, and particularly in those employed in medicine. M. Rabourdain has recently published a note on the employment of this product. According to him, chloroform detects, in a liquid, less than *a hundred thousand* of free iodine held in solution. If this minute fraction is the smallest portion that chloroform can detect by the violet color which it takes, it must be owned that the advantage still remains on the side of starch, which detects $\frac{1}{100000}$ of it, that is to say, four times as small a quantity of it.

This fraction is not, however, the smallest quantity of it that starch, rendered soluble, is capable of indicating by its blue coloration; we have proved that in operating on a litre of distilled water containing 0·0013 of iodide of potassium, representing 0·001 gr. of iodine, the latter set at liberty by a drop of a very weak solution of quinine, or by a mixture of a few drops of nitric and sulphuric acids, gave rise to a faint blue coloration, quite appreciable beside a similar bulk of liquid placed before a sheet of white paper. Now, the effect produced in this case is determined by a proportion of free iodine forming a hundred millionth of the weight of the water.

Experiment has demonstrated to us that, in this state of division, iodine, set at liberty by the action of chlorine or of the mixture of the above-mentioned acids, was not detected by chloroform agitated with the solution; the solution remained entirely colorless.

We have been curious, on this occasion, to verify the delicacy of *bichloride of palladium*, which we had already proposed as a reagent for the iodides dissolved in water, more than twelve years ago. The experiment which we have lately tried has convinced us that it directly manifested the presence of the alkaline iodides when starch could not do so; thus, $\frac{1}{2000000}$ of iodide of potassium in a mass of distilled water equivalent to 2 litres or 2000 grammes, was very soon detected by the brown tint acquired by the water operated on. After a repose of from 24 to 36 hours, the iodide of palladium collected in brown flocks at the bottom of the vessel. This iodide, although in such small quantity, can be collected by decantation and afterwards dried in a small capsule. The chemical reactions produced on this compound denote its true nature.

Thus this iodide of palladium, heated in a small glass tube, is decomposed, and allows iodine to sublimic in small but quite distinct plates. When the iodide of palladium cannot be collected on account of the smallness of its proportion, it is mixed with a little moistured silica, and, after desiccation, it is heated in a small glass tube over a spirit lamp. The violet vapor which is produced then detects the presence of the iodine.

Another advantage of the employment of bichloride of palladium for detecting the smallest quantities of combined acid, is that of acting without the intermedium of other bodies, as is the case with starch and chloroform, which can detect its presence only when it has been disengaged from the compounds in which it exists. Now, as it is most commonly in the state of iodide that it is met with, whether in waters or in plants, or other organic matters, and as it is into this state that it is always made to pass in order to be afterwards detected, when it is sought for in substances which admit it in a state yet unknown, it is evident that the action of the bichloride of platinum is as direct as certain within the limits in which the sensibility of this reagent can be manifested.

* Sulphuret of carbon acts on free iodine dissolved in water like chloroform; it is colored of a beautiful violet; this fact, pointed out in Berzelius' *Chemistry*, has been reproduced by other authors, and proposed for appreciating minute quantities of free iodine.

ON THE ESTIMATION OF OXALIC ACID AND THE SEPARATION OF THIS ACID FROM PHOSPHORIC ACID.*

BY M. H. ROSE.

THE ordinary process of estimating oxalic acid consists in precipitating it by a salt of lime in the state of oxalate of lime, in afterwards converting this oxalate of lime into carbonate or into sulphate whose weight serves for calculating the proportion of oxalic acid.

When the oxalic acid is engaged in an insoluble combination, it is boiled with carbonate of potassa and soda in order to dissolve the oxalic acid, which may then be estimated as formerly.

Professor H. Rose has ascertained that in general the estimation of lime by oxalic acid gives more accurate results than the

* *Journal für prakt. Chemie.*

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estimation of oxalic acid by lime. For the oxalate of lime has a tendency to combine with small quantities of calcareous salt which is added in excess.

A more accurate process of estimation consists in oxidising the oxalic acid by chloride of gold. This reaction enables us to estimate this acid even when it is mixed with other acids, especially with phosphoric acid, from which it would be very difficult to separate it by another process. It is known that the two acids are met with together in guano.

For the reduction of gold by oxalic acid to take place easily, the liquor must contain little or no free hydrochloric acid.

Free sulphuric and phosphoric acids do not, like hydrochloric acid, prevent the reduction of chloride of gold.

ON A PECULIAR PROPERTY OF ETHER AND SOME ESSENTIAL OILS.*

BY DR. C. F. SCHŒNBEIN.

THE property referred to by the author is similar to that which phosphorus has been long known to possess, when put, under certain circumstances, in contact with pure oxygen, or with atmospheric air, of developing a highly oxidising agent which has been called ozone.

The author finds that if a little pure ether be put into a bottle filled with pure oxygen or atmospheric air, and exposed to diffused light, the bottle being occasionally shaken, the ether, after the lapse of four months, will have acquired new properties. Although producing no action upon blue litmus paper, it will discharge the color of solution of indigo, convert pure phosphorus when immersed in it, into phosphorous acid, eliminate iodine from iodide of potassium, change pure sulphate of protoxide of iron to the basic and acid sulphates of the deutoxide, transform yellow prussiate of potassa into the red salt, convert sulphuret of lead into the sulphate, &c.

Similar effects are produced with oil of turpentine and oil of lemons when treated in the same way as the ether.

The author expresses an opinion that the property which these substances thus acquire is due to the presence of oxygen in a chemically exalted condition.

* *Medical Gazette.*

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

PHOTOGRAPHING IN NATURAL COLORS.*

WE are now called upon to notice the greatest and most valuable discovery that has been presented to the public since the announcement of the Daguerreotype by Daguerre, and the Telegraph by Morse. With these names we now add another, of one whose great perseverance and energy has ranked him with the first discoverers in the world. This gentleman, like Daguerre, has given much time and manifested much skill in conducting his experiments, and is entitled to great credit.

L. L. Hill, of Westkill, this State, has discovered a process of producing impressions upon metallic plates with all the "colors of nature;" and as the process is "essentially different from Daguerre's," and wholly unlike all others, we will (as it has been left with us to "christen") name it "Hillotype."

We are led to believe that the Hillotypes will supersede the Daguerreotypes, as the former will be altogether preferable. The discoverer *has* produced copies of colored engravings, "true to the tint." Each particular shade is presented with all the softness in nature or art, and marked with a delicacy and brilliancy which no pen can describe and no imagination picture. They are unlike a Daguerreotype, as they can be seen in any light, and possess beauty that no artist can paint, while at the same time they present Nature as she is.

We feel convinced of the durability of the Hillotypes, from the fact that two impressions have been, for four months past, exposed to the direct rays from the sun, on an average of about six hours per day; these pictures have undergone no perceptible change; and from this we conclude that they are equally durable with the Daguerreotype. In the practice of Mr. Hill's discovery there will be required similar care and skill to that required in that of Daguerre's. Mr. Hill, in one of his com-

* *Daguerrian Journal*, (New York) and *Mechanic's Magazine.*

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munications to us, says, "My process involves the use of, at least, one substance *entirely new*; which, though it is my own discovery, I cannot name, and is unlike anything ever named by chemists." We are led to believe that the world will be as much astonished at the means employed as at the beauty of the results. This gentleman is desirous of perfecting his process so far that in a few hours a skilful Daguerreotypist may gain a full knowledge, and be enabled to operate successfully; and he has strong hopes that, in a few weeks, he will be enabled to work with certainty, and produce "instantaneous impressions." This last will be a great advantage; as then we shall be enabled to produce a faithful counterpart of children, which will, in this particular, prove an invaluable discovery. We predict that the Hillotypes will not be confined to the taking of likenesses, but extend to the production of *views* from nature, in a form more extensive than has heretofore been dreamed of. Think but for a moment of a view, five feet square; what must be the value of such a picture, in which all the "colors of Nature" are faithfully represented, and it is out of the reach of art to copy? We conclude for the present, and look forward with interest to that hour when Mr. Hill shall have made the proper arrangements, and secured to himself the right and reward to which he is so justly entitled. *Let this be distinctly understood, that this process will not be monopolised*; but be placed within the reach of all worthy Daguerreotypists and artists.

We should say that some little difficulty has been experienced in producing one color (the yellow), but now, it has in a measure, been obviated, and not a particle of doubt remains but that all colors *have been* and *can be again produced* by the Hillotype process. The following communication will be received with interest:

THE NATURAL COLORS.

Mr. Editor,—It has been pretty widely circulated that I had discovered a process for photographing in colors. The facts are these:—Some two years ago I took to experimenting, with a view to this great desideratum, but with little faith; in one of my experiments a phenomenon presented itself which greatly surprised me, and, in the nature of the case, compelled me to believe the thing practicable. One color, the *red*, in a figured dress, was developed as bright as a ruby. I then repeated the experiment, and failed; but, from that hour until a few months ago, I continued to repeat it in every form I could think of—always failing, but never despairing—for I had reasons for believing in the correctness of my theory, that, *under certain circumstances*, there is on the impressioned plate a *latent-colored image*. I at length commenced experimenting on the *developing power* of the vapors of different metals, and found that a large number of them,—such as arsenic, padmium, zinc, selenium, bismuth, potassium, and sodium,—would, when properly vaporised, bring out the latent image in light and shade. The same result followed the use of several gases. The impressions differed so little from Daguerreotypes, that I was on the point of abandoning the pursuit; when I one day unexpectedly formed a singular compound, and, without much hope of success, applied it to my purpose.

My surprise and joy were unbounded when I found on my plate a true Hillotype. The same process, with some variations, I have followed since, always with good results. I have now forty-five specimens, all of which present the several colors, true to a tint, and with a degree of brilliancy never seen in the richest Daguerreotype; and this is true also of the whites and blacks. The pictures have much the appearance of *enamelling*, and I believe are equally durable, for it is very difficult to efface them by scouring; and, as far as I can judge, they are not acted upon by light. My process bears no resemblance to Becquerel's, and is essentially different from Daguerre's.

My success in *quickening the plates* has been equally gratifying; and I have but little doubt of being able to operate in diffusing light *instantaneously*, having already reduced the time of sitting to much less than that required for Daguerreotyping. I shall continue experimenting until I have perfected the discovery as far as I can; when I shall secure my right, if possible, by a *special patent*, and offer the process for sale, on reasonable terms, to all worthy Daguerreotypists. Several eminent artists, from Philadelphia, and other cities, who have visited or corresponded with me, advise me to this source. I have been offered 20,000 dollars for an interest of one-half; but whatever disposition I may make of it, it *shall not be monopolised*. I am told, by those well qualified to judge, that my discovery will completely supersede Daguerreotyping; but it may be well to state, that very few of the appliances or manipulations of the Daguerrian-room, will have to be dispensed with.

With best wishes for your success,

I remain, fraternally yours,

L. L. HILL.

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We extract the following additional information on the subject of this remarkable discovery, from a communication by Mr. Hill to the (American) *Photographic Art Journal*:—

"The discovery is due to some chemical compound, a nondescript to me, though I have made the science of chemistry my study for years. That it is a new substance, or combination of substances, I am positive; and this is all I know concerning it. It is simply and easily produced, but not by any law stated in the large number of chemical works with which I am familiar. Doubtless, however, a correct and thorough analysis will determine its nature."

[Mr. H. had forty specimens of pictures taken by his discovery at the date of his letter. Three of these are thus described.:]

"1. A view, containing a red house, green grass and foliage, the wood color of the trees, several cows of different shades of red and brindle, colored garments on a clothes-line, blue sky, and the faint blue of the atmosphere; intervening between the camera and the distant mountains, very delicately spread over the picture as if by the hand of a fairy artist.

"2. A sunset scene, in which the play of colors upon the clouds is impressed with a truthfulness and gorgeous beauty which I cannot describe.

"3. Several portraits, in which I have the true complexion of the skin, the rosy cheeks, and lips, blue and hazel eyes, auburn, brown, and every color of the drapery. Changeable silk is given in all its fine blendings of colors, and delicate richness of hues. I not only get red, blue, orange, violet, &c., but their various tints. The whole impression, including the lights and shades, is far more brilliant, round, and mellow, than the most superb Daguerrean image I have ever seen."

Mr. Hill adds:

"I have a most exquisite type of my little girl (one year old), taken in the act of *crying*, the plate not having been exposed a full second. At the same time, my light required fifteen seconds for a daguerreotype. This picture has caught the expression perfectly, both of the eye and whole face On one cheek is seen a bright tear-drop, and the color showing through it much deeper than the surrounding parts; which latter I suppose, is owing to the refractive action of the fluid."

The only difficulty stated to be now experienced is in taking yellow colors.

IMPROVEMENTS IN PHOTOGRAPHY.*

In the following account, which we compile, among other sources from the *Art Journal*, of improvements that have been made in this art, it will be found, that we are to expect some magnificent evidences of these improvements, in the shape of specimens which will be exhibited at the Crystal Palace. Amongst these, are some photographic positives from glass negatives, in which the great defect which has hitherto attended photographic pictures, the want of definition in their shadows, is entirely removed: and the full details of the objects represented, are most delicately preserved. The want of that harmonious gradation from light to shadow, which always renders the tone of common photographic pictures somewhat harsh, and frequently even unnatural, will be no longer felt; for in these new productions the interplay of light and shadow is most perfect and harmonious. This improvement is stated to be French, and we hope soon to have a description of it.

The *Art Journal* speaks in the most glowing terms of some specimens, which have been received from Philadelphia, executed by a new process, called by the inventors, Messrs. W. and F. Langenheim, of Philadelphia, "the hyalotype," from Greek words signifying glass and printing. The distinguishing features of this invention consists in the material upon which the impressions are taken. The inventors have substituted plate glass for paper in the negative, and also in the positive, altering the process to suit the new material. The best paper is always a fibrous substance, and in the common process the texture of the negative paper is always imprinted on the positive picture; and from this cause, very few Talbot-types were fit to be shown, until they were touched up by hand. In portraits especially, this is very disadvantageous, as the process is very apt to destroy the likeness.

The most interesting application of this discovery is stated to be the formation of pictures on magic-lantern slides, taken from nature by the camera obscura, without the aid of pencil or brush. These pictures are prepared by the action of light alone, upon a prepared glass plate, by means of the camera obscura; the smallest details being delineated on the glass with an astonishing fidelity. When these slides are magnified in the magic lantern, they give a perfect representation of nature, and are perfectly free from all those defects and

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inaccuracies existing in the old slides, which never can be avoided in painting upon so small a scale. In examining these small pictures by the magnifying-glass, the great accuracy with which nature is copied, is then made fully apparent. In minuteness of detail, as well as in general effect, they surpass even the daguerreotype impressions, as the light passing through the pictures gives a better effect, in the deep, yet perfectly transparent shadows.

The *Art Journal* states that the delicacy and perfection of the details of these hyalotype pictures cannot be overstated. In the specimens examined by that journal, the delineation of the details is so strikingly perfect, that the finest and most delicate lines are pourtrayed with the greatest distinctness; and the more they are enlarged by the lens, the more perfect and beautiful they appear. They are precisely such representations of nature as would be seen in a very brilliant mirror. The exquisite delicacy of the "hyalotype" is, however, more strikingly shown in the copies of engravings; in these, not only is the picture copied, but every line; the most delicate touch of the engraver is retained; and, when enlarged by a magnifying glass, it is seen that even the texture of the paper is preserved. The correspondent of the *Art Journal* says that, accustomed as he is to every variety of photographic pictures, and having studied the art for years, he is astonished at the perfection of the details here preserved.

A peculiarity of the process of "hyalotyping" consists in the colors given to the pictures. There are among the specimens, some of a rich warm brown, and some, of a deep sepia; while the copies of engravings are intensely black, thereby preserving the character of the original. The inventors have taken a large number of views of many interesting places and edifices in the United States, as well as portraits of some of the most distinguished men; a large number of these beautiful productions having been forwarded to the exhibition, together with large panoramic views of the Falls of Niagara, some satisfactory attempts having been lately made in carrying out the application of photography to impress designs upon wood, for the purposes of engraving. This will allow the engraver to proceed at once to his work, for the object to be represented will be copied at once on the block, and the labor of drawing it on, avoided. It is stated that the "hyalotype" picture can be very easily transferred to the wood, by the process of the Messrs. Langenheim.

In evoking these pictures, and giving sensibility to the silver salt, it has been found that pyro-gallic acid is much superior in every respect to gallic acid, and is, besides, much more easily prepared, being only a strong decoction of gall-nuts evaporated, by a moderate heat, to dryness, and then sublimed from the dry mass thus formed, by the action of a higher temperature. Judging from the effects produced by the proto-salts, there is every reason to believe that the proto-nitrate of iron, which has lately been recommended, in the development of photographic pictures, will prove a valuable agent. But at present its use would appear to require the paper prepared with it to be in a damp state, which would be a great inconvenience to the traveller.

ON A METHOD OF OBTAINING DAGUERREOTYPE IMPRESSIONS ON METALLIC SURFACES, FREE FROM THE USUAL MIRROR-LIKE APPEARANCES.*

BY MM. CLENISSON AND TERREIL.

It is well known that the mirror-like appearance of the Daguerreotype plate destroys, to a considerable extent, the artistical effect. In studying the well-known influence of the chloride of mercury in preventing the chloride of silver from becoming colored, on exposure to the light, we arrived at a method of completely preventing the mirror-like appearance, without interfering with the delicacy which characterizes the daguerreotype impressions.

Our process consists in submitting the impression, after washing it in the hyposulphite of soda solution, to the action of very weak aqua regia, which transforms the amalgam producing the white parts of the impression, into chlorides of silver and mercury inalterable to the action of the light, and which produces on the dark parts a chloride of silver, susceptible of alteration under the influence of light. After this operation the harmony of tints is preserved, and the image is fixed as if by chloride of gold.

Specimens of the new process were, at the same time, submitted to the inspection of the members of the Academy.

ON THE ELECTRO-COLORING OF POLISHED METALLIC OBJECTS.†

BY M. BERGEAT.

For many years past, we have had intro-

* *Paris Academy of Sciences.*
† *Patent Journal.*

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duced into domestic use a variety of clock-bells, and other articles of brass, which are decorated by brilliant coloring, generally red or green, and more remarkable for elegance than utility.

The process of coloring, it is well known is performed by the decomposition of a solution of oxide of lead in potassa ley, by means of a galvanic current. A knowledge of manipulation is, however, necessary for the perfect success of the process; this I now proceed to describe, as well as the whole process.

To obtain the proper solution of oxide of lead, in the potassa ley, a bath is prepared, containing about 500 grammes of caustic potassa, a litre of water, and a few teaspoonfuls of oxide of lead (such as massicot or powdered litharge), stirring it with an iron spoon, in an ordinary pot; the liquor must be kept boiling, and when clear, on cooling, separated by decantation from the deposit.

For the galvanic current, a simple Bunsen battery is used, which is set in action by means of nitric acid, of moderate strength, and dilute sulphuric acid. If any inconvenience be apprehended from the vapors arising from this apparatus, it is preferable to use two piles of Daniell's battery, charged with a solution of sulphate of copper and dilute sulphuric acid, so united as to give increased tension, as one pile, especially if not in good working condition, is often found insufficient.

The energy of the current is, as usual, modified by the quantity or degree of concentration of the acids used, but a few trials will adapt it to the operation; in the present case, it must be remarked that, *after* the coloring matter, (the peroxide of lead) is deposited on the metal, it must still remain exposed to a current, at least strong enough to decompose the water of the lead-solution above described. The slower the current produced by the battery, the more certainly can any particular shade be produced, and the more uniform and durable is the effect.

When the galvanic apparatus is ready for use, and the caustic ley prepared, a vessel of lead or brass, three or four times the size of the object to be colored, is filled with it. The object to be colored is put into communication with the zinc, by means of a metallic wire, which in its turn, by means of a copper wire, is put into communication with the charcoal, or copper element of the galvanic battery; it is then plunged into the leaden solution in the vessel, taking care that it does not touch the sides; at the end of a minute or so it may be withdrawn, when it will be found to have acquired the desired color. I now speak only of objects whose surfaces are curved or convex.

The color depends on the length of time during which the galvanic current acts; and, both on the alloy, of which the table clock-bells, and other bells are made, the color passes through every shade, from golden yellow to orange, then red, deepening in intensity until it becomes blue, and finally green. If continued beyond this, the colors become darker, and have no brilliancy whatever.

Some experiments, made with a view of attaining the highest possible perfection of color, quickly showed why the colors are not of a uniform shade; it was found, among other things, that on the angles and projecting corners, the color first appears, at the points where the electricity is necessarily conducted, and on these points the color often begins to change and darken, whilst other parts have not yet acquired the shade of color desired; and also that the parts which are the first colored are those nearest to the sides of the vase containing the leaden solution. The parts arranged horizontally, and parallel to the surface of the bath, are the last to be colored, and sometimes resist the operation altogether.

The first two inconveniences may be in a great measure remedied by using a sufficiently large vessel, similar in form to the object which is to be colored, plunging the latter carefully into the middle of the vessel. The third of these inconveniences may be remedied by a double immersion, but in reversed position, in cases where that manipulation is necessary.

It is not uncommon to see spots upon the metal, when the vessel containing the lead solution is in communication with the battery, at the moment of immersion; but a pure and uniform color is obtained by first immersing the object, then pressing the metallic wire, which establishes the communication with the battery, on a roughened edge of the vessel, all the time the object remains subject to the action of the current.

This method of establishing communication by the hand has, however, one objection; when the galvanic current is not sufficiently strong to decompose the water over the whole surface of the object immersed, it becomes coated with a greyish-white stucco, or covering of oxide of lead, which separates more readily from the potassa than the elements of the water do from one another; in this case it becomes necessary to scrape the metal and repolish it.

If the exterior surface of the object to be colored has not been sufficiently cleaned and

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polished by rubbing it with chalk or other substance adapted for the purpose, the finger marks will be visible after the process of coloring has been effected. If an article has not been properly colored, all that is necessary is to rub off the layer of coloring deposited, and to renew the operation. The cost of the process is but trifling, the principal expence being the time required to effect the coloring.

ON THE ARTIFICIAL FORMATION OF RUBIES AND OTHER MINERAL SUBSTANCES.*

BY M. EBELMEN.

THE communication which I have the honor of submitting to the Academy, is an account of my researches on the application of the new method of crystallization, a notice of which I submitted to the Academy about three years since (*vide Patent Journal*, vol. 4, p. 89). I had succeeded in producing, by this method, in the state of perfect crystals, a number of mineral substances, some of which were rare and precious stones. The crystals obtained were well defined, presenting all the characteristics of natural crystallizations, but the shortness of the time allowed for the evaporation of the dissolving medium (being limited to the time required for the baking or firing of porcelain, in the furnaces at Sevres), did not permit of my obtaining crystals of any notable size.

M. Baptaross, a manufacturer of porcelain buttons. kindly placed at my disposal the muffles which he uses for baking the products of his manufacture, which remain in the furnace for several months. The temperature of these is somewhat lower than that of the porcelain furnaces, but I have, nevertheless, succeeded in obtaining most of the combinations which I obtained in the porcelain furnace, and have thus been enabled to verify the correctness of the views enunciated in my former communication to the Academy. By operating on large quantities of alumina, magnesia, and boracic acid, and by leaving the platinum capsules which contain the mixture exposed for several days consecutively to this uniform temperature, I have obtained octahedral rubies, perfectly distinguishable to the naked eye, the angles of which could be measured. They all present the form of truncated octahedra, the emarginated octahedron of Haüy. They are perfectly transparent. Some of these regular octahedra, which I now submit to the inspection of the members of the Academy, are as much as three or four millimetres across.

After describing a variety of other mineral combinations obtained in the same way, M. Ebelmen proceeds, "In my former communication, I indicated the preparation of alumina by means of borax; but the crystals then obtained were visible only by the aid of the microscope. By the addition of a small quantity of some substance to the borax, capable of imparting to the flux a little more stability, such as silica, or carbonate of baryta, I have obtained crystals of alumina of very great beauty and lustre, having a density of 3·928, and hard enough to scratch topaz readily."

* *Paris Academy of Sciences.*

COPROLITES, OR FOSSIL MANURE.*

BY MR. ISAIAH DECK.

FROM the many inquiries I have recently had respecting the "diggings" at Barnwell, and the repeated specimens I have received from various localities, of these nodules for information as to "what they were," I am induced to trouble you with a few observations on these remarkable productions of our strata. The extraordinary deposit of these curious substances, whether from the abundance in which they are found, or that they should at this remote period contain almost all their original organic matter, considering the countless ages they have remained buried, must be a matter of astonishment to all reflecting minds; but now that they are becoming a considerable article of commerce, it is a matter of interest to those who possess them on their lands, and to whom they now probably pass unheeded as common debris, or gravel fit only for road mending. I have no doubt that wherever there is an out-cropping of the upper green sand (the stratum in which they are found)—and it extends a considerable distance around Cambridge—that there these peculiar nodules may be met with. And this, the surface-bottom of an ancient deep sea, appears to have been the receptacle of the bones and fæcal matter of its inhabitants for a long period, which matter is now, by the united penetrating researches of the chemist and geologist, brought to light, as containing the fertilising principle and pabulum of vegetable life, verifying the great axiom ot chemistry, that nothing is lost in organic atoms, and that the refuse of former ages in an indirect manner produces the gold of the present.

* *Cambridge Chronicle.*

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The parish of Barnwell contains an extensive area of these coprolites or fossil dung. In a field near the railroad bridge, the upper green sand appears on the top of the gault, varying from eighteen inches to six feet below the surface, and from six to twenty inches in thickness; over this is a mortar-looking conglomerate, resulting from the debris of denuded chalk, from which these substances are now being raised in considerable quantities; where the depth from the surface is greatest, there the deposit also appears to be greatest. For years the article now so much sought after has been the bane of the brickmaker, and TONS have been thrown into old excavations to get them out of the way as useless rubbish, while from £60 to £80 have now been given for liberty to dig over a two-acre field. From the railroad to the opposite side of the river at Chesterton they may be traced, and to a considerable extent on both sides of the river to Horningsea, where, I understand, diggings are going on.

From Denny Abbey across the county to Cottenham Common, the green sand crops out; and although it varies in geological position, it may be well for those interested to examine if it does not contain these coprolites. On the west side of the town they may be found in considerable quantities lying upon the surface; the fields on each side from the Barton road to Grantchester abound with them, and they are probably to be met with between this point and the escarpment of the chalk at Orwell, but which beyond the turnpike I have not investigated. On examining a field of potatoes in the parish of Wimpole, to trace the disease, I was struck with astonishment at the extraordinary quantity abounding on the surface there. Beyond this, the diluvial patch of clay that covers the chalk cuts off all geological probability of finding them.

The appearance of these nodules is in shape various; generally a hard, black, water-worn looking stone, with excresences, some with convoluted marks, bearing the impress of the intestine, and rounded off at the extremities—the surface of all exhibiting lines from the decomposition of its more destructible component parts. Portions of coral, ammonites, crustacea, sponges, &c., may be found in the agglutinated mass. They vary in size from a small bird's egg to masses the size of a fist. A large selection from our own, as well as from distant localities—the lias of Lyme, the chalk of Farnham, the slate of Newhaven, and the crag of Suffolk—I have open for the inspection of those interested.

The process which they go through to render them available for use may not be out of place. After being selected from the soil, they are well washed by rotatory machinery erected on the spot, and then conveyed by rail to the manufactory, where they are ground to a very fine powder, an operation, from their hardness, of no small difficulty, vertical granite and buhr stones being required. The powder is mixed with about an equal portion by weight of strong sulphuric acid, by the action of which it is reduced to the state of a superphosphate, and is thus sold under the name of Coprolite and Acid. This is, I believe, part of the process used in the manufactory of Mr. Lawes, who produces a very superior article, and to whom we are much indebted for his early attention to supply the increasing demand for phosphates as artificial manure, and who has been supplied with thousands of tons from digging over a four-acre field at Walton, in Suffolk, the subsoil of which was crag, producing to the farmer a much richer harvest than grain at the present free-trade prices. In an article, varying as it necessarily must from extraneous matter, the component parts materially differ. The following analysis may be taken as an average of ther composition, 100 parts containing

Earthy phosphates.....	61
Carbonate of lime and iron...	24
Insoluble	12
Moisture.....	3
	100

Mr. Lawes, from a sample from the same locality, made seven parts more phosphates, and Mr. Potter four less than the above analysis of my own.

There is a prevalent idea that these coprolites are almost the same as guano: this is a great mistake; for although our own production yields a larger proportion of the phosphates, it is devoid of salts of urea and ammonia, which, in combination with the phosphates, increase to a considerable extent the fertilising principle for which that foreign article is so celebrated. It has been the object of artificial manures to supply synthetically the composition of guano at a much reduced rate.

In respect to the value of coprolites in our locality, besides giving employment at this season to many idle hands, a bonus has been given for the right of royalty over the soils, and 5s. per ton is paid the proprietor for all raised. This, with labor, washing—a troublesome and tedious process—and rail charges for delivery in London, costs from 35s. to 40s. per ton.

To show the comparative value of the

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different substances containing the phosphates, and that of guano, an analysis of a good sample is here given, and that of the phosphates and carbonate of lime in various bones. That portion contained in the fossil remains of bone and coprolite is a beautiful illustration of the goodness of the Great Author of Nature;—remains which, after being interred thousands of years, are by the labors of man brought again into action, that their elementary parts may be again separated and made subservient to his uses.

ANALYSIS OF GUANO FROM PERU.

Urate and salts of ammonia	34·05
Various phosphates	37·04
Carbonate of lime.....	1·65
Soda and potassa	8·92
Silex	4·28
Water and indefinite organic matter	14·06
	100·00

COMPARATIVE ANALYSIS OF BONES.

	Phosphates.	Carbonate of lime.
Recent human bones	81·09 ..	10·03
Ancient ditto, from Roman tumulus.....	76·38 ..	10·13
Fossil bone from the Crag..	60·02 ..	18·00
Recent ox bones	57·35 ..	3·85
Sheep bones	80·00 ..	90·03
Bones of the hen	88·09 ..	10·04
„ frog.....	95·02 ..	2·04
„ fishes	91·00 ..	5·03

ADULTERATION OF MANURES.*

BY MR. W. C. SPOONER.

THE attention of the agricultural public has recently been directed very properly to the extensive adulteration carried on with guano and other manures. Allow me to observe that agriculturists have themselves to blame very much for the extent of this mischief, by their incessant craving after cheapness, and their encouragement to anybody and everybody who will minister to their depraved appetite, for depraved it undoubtedly is, when indulged in with almost total disregard to the real merits of the articles purchased. It is sufficient for a manure to be offered in the market, under the name of some recognized manure, at a less price than that at which the genuine article can be purchased for, from some respectable manufacturer, and some farmer will be found silly enough to purchase it, provided always, that it smells good.

For the accuracy of the following cases the writer can vouch, and they are all of recent occurrence.

CASE 1.—A respectable farmer, a few weeks since, purchased a certain quantity of top dressing for wheat, from a total stranger, so much so, that he absolutely forgot the name and abode of the party, having taken no memorandum of the transaction, and was therefore unable to complain of the non-arrival of the manure at the time appointed. He knew nothing of the party previously, and was not recommended to him, but was induced to purchase solely because the manure appeared cheap, and had a strong smell.

CASE 2.—Some time since, a quantity of Peruvian guano, stated to be of the finest quality, was purchased by some gentlemen of a London dealer, at 12s. per ton under the price that would have been charged them in the regular course of business. A week since, a sample of the article was sent to the writer for examination, and on submitting it to a few analytical experiments, I readily found that it possessed double the water, and double the ash contained in genuine Peruvian, and that in fact it was damaged Peruvian extensively adulterated with earthen admixtures.

CASE 3.—A quantity of inferior Chilian guano has lately been extensively sold by corn dealers as genuine Peruvian, at 20s. under the market price, the guano being mostly taken in exchange for corn. This system of barter is very injurious to farmers, and they stand in their own light when they encourage it.

CASE 4.—A quantity of inferior wheat was offered to a manure manufacturer for a given quantity of superphosphate of lime. who made a calculation, allowing the full value the wheat would realise, and offering the utmost quantity of genuine superphosphate that could be sold for the amount in exchange; but this would not suit the farmer, who went to a corn merchant not quite so scrupulous in the quality of his manures, who at once accepted the bargain.

I have mentioned these facts to show the very loose manner in which the farmers spend their money in the purchase of manures, and the encouragement they are thereby giving to dishonesty and fraud; and I venture to assert that amongst the various suggested methods of remedying the evil complained of, none will be found more effectual than that of paying some regard to the standing and respectability of the party from whom manures are purchased, and enabling, by giving him a fair price, to retain the genuineness and quality of his manures.

* *Agricultural Gazette.*

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MEMOIR ON THE CAKES OF OLEAGINOUS SEEDS.*

BY MM. E. SOUBEIRAN AND J. GIRARDIN.

(*Continued from page* 315.)

9. If, relying on our analyses, it be investigated what are the quantities of the different cakes to be employed in manuring a hectare, taking as a point of comparison good farm-yard manure, and confining ourselves to the two principal elements of manures, nitrogen and the phosphates, the following numbers are obtained.

In the 30,000 kilogrammes of farm-yard manure which is generally employed at the commencement of the rotation of three years, the most common system, there are :—

124 kilogr. of nitrogen, and
81 „ of bone phosphate.

To obtain the same quantities of these two substances with the cakes, the following proportions of each of them are necessary.

	For nitrogen.	For the phosphate.
Hemp-cake	2000 kilog.	1140
Linseed	2066	1174
Colza	2234	1246
Poppy	1171	1285
Camelina	2226	1930
Sesamum	2226	2531
Beech	2755	3810
Pistachio	3031	6750

Almost everywhere the colza-cake is used as manure. In the North of France and in Flanders, from 12 to 1500 kilogrammes are used per hectare; in the plain of Caën, 1200 kilogrammes; in England, about 1000. The average is 1200.

Now it results from the comparative cyphers in the foregoing table, that the 1200 kilogrammes of colza-cake, found practically to be sufficient for manuring a hectare, contain precisely the same proportions of phosphate as dung does, but that this quantity is about one-third poorer in nitrogen.

Hemp, linseed and poppy-cakes, which are ordinarily less employed as manure, are very nearly in the same position.

If, relying on theory, it were wished to deduce consequences from these facts, it must be said :—

1. That it does not matter which of these four kinds of cake is employed, and that the price or facility of source must alone decide the preference to be given to any of them.†

We may here remark that the prices of 1849 are much lower than those of former years; thus, the average price of 100 kil. of colza-cake, in the market at Lilles, from 1845 to 1847, was :—

	fr. c.		fr. c.
1845 from	18 12	to	20 88
1846 „	18 29	„	20 70
1847 „	22	„	24

2. That according to the chemical composition of these cakes, they could not, in the proportion ordinarily employed, satisfy all the requirements of the triennial rotation, but that they are appropriate to the culture of exhausting plants, which require, in each year, an abundant quantity of active principles. This, indeed, has long been demonstrated by practical experience. M. Matthieu de Dombasle, who ought always to be consulted in agricultural practice, expresses himself as follows :

"I have remarked that colza-cakes, spread in the proportion of 1250 kilogrammes per hectare, commonly produce, provided that the season be not too dry, an effect which may be compared with manuring with stable manure, in the proportion of 30000 to 40000 per hectare, but for the first year only, the cakes scarcely extending their action further.

At the ordinary price of the cakes, it is scarcely economical to employ them for cereals, unless the seeds are of very high value. But if an artificial meadow has been sowed with the cereals, the question entirely changes its character; for then the cakes contribute essentially also to ensure the success of the artificial meadow, by the vigor with which they impress the vegetation during the first year, and the success of the artificial meadow likewise ensures that of the cereal which has to follow it; so that, in this case, the cakes really increase the product of several successive crops. The same observations may be applied to several other kinds of pulverulent or liquid manures whose action lasts, in general, only one year, and which may, by this combination, be employed in a much more profitable manner.*

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*Journal de Pharmacie.

† The ordinary load of farm-yard manure, weighing 2000 kilogrammes, generally costs from 10 to 15 francs. This makes the manuring of a hectare, in the proportion of 30000 kilogrammes, amount to from 150 to 225 francs.

		fr. c.		fr.
1200 kil. of colza-cake at		12 75†	cost	153
1200 „ „	poppy „	12	„	144
1200 „ „	hemp „	12 50	„	150
1200 „ „	linseed „	15 50	„	186

* *Annales de Beville*, t. v. p. 492.

† Price of 1849.

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The sesamum employed in the proportion of 2200 to 2500 kilogrammes per hectare, contains nitrogen and the phosphates in the same quantities as farm-yard manure. But this matter rarely exists in our northern markets, so that it is difficult to learn the price of this manure.

The camelina employed in the proportion of 2000 to 2200 kilogrammes per hectare, is exactly in the same situation; but its price is too high. It costs 12·75 the 100 kilog.; which would bring the cost of manuring the hectare to 255 and even 280 fr.

The pistachio and beech are poor in phosphates. To furnish a quantity of phosphate equal to that which is found in 30000 kilogrammes of dung, it would require not less than 6750 kilogrammes of pistachio-cake, which would cost, in the proportion of 6 francs the 100 kilogrammes, 405 francs. But as, on the other hand, 3000 kilogrammes of this cake are sufficient to supply the quantity of nitrogen required; it results from this that there would be more advantage in employing this cake only in mixture with substances rich in phosphates, such as bones and animal black.

The same may be said of beech-cake, 3810 kilogrammes of which would be required in order to have as much phosphate as is contained in farm-yard manure, and only 2750 kilogrammes for the quantity of nitrogen, so that the proportion of phosphate to be mixed with it should be less than for the pistachio-cake. Its employment would be moreover less expensive, since its price is the same as that of pistachio, (6 francs the 100 kilogrammes) and since a smaller quantity of it would be required.

10. Of all known manures, that which has the greatest relation to oil-cakes is poudrette. In establishing, as we have done with the cakes, the quantity of it which would be necessary for replacing the nitrogen or the phosphates of farm-yard manure, we have found that 7000 kilogrammes would be required in the first case, and only 1100 kilogrammes in the second.

Now, to manure 1 hectare of land, there are required, according to Jacquemin, 20 hectolitres of poudrette of 78 kilogrammes each, or 1560 kilogrammes, and, according to one of us, 22 hectolitres or 1750 kilogrammes.

These 1750 kilogrammes contain:—

Nitrogen ..... 31 kilogr.
Bone phosphate .... 315 ,,

That is to say, 93 kilogrammes of nitrogen less than dung and 234 kilogrammes more of bone phosphate.

It is evident that here, as in the cakes of colza, poppy, hemp and linseed, and in a higher degree, nitrogen is deficient and the phosphates abundant; which does not prevent poudrette from being a very energetic manure. It has the advantage over cakes of containing the nitrogenous matter in a state which renders it sparingly soluble in water and less susceptible of being lost by the rains of winter and spring. It may be hoped to make the cakes participate in this advantage by associating with them a certain quantity of lime; indeed, the vegetable albumen and casein which constitute their nitrogenous principle are susceptible of forming with lime an insoluble combination which putrifies slowly, and only very gradually developes the ammonia for the plants to absorb.

It is very curious that practice has led to precisely the same conclusion. In fact, the best agriculturists of the plain of Caën have proved that the cakes act perfectly well in calcareous and argilo-calcareous soils, but are almost inert in argilaceous soils. Schwerz recommended the addition of 1 part of lime to 6 parts of cake for manuring cold, that is to say, argilaceous soils, and one of us had already given the same advice to Norman agriculturists.

11. When, to establish the comparative value of cakes, their comparative richness in nitrogen alone is attended to, as MM. Boussingault and Payen have done, we arrive at excessive estimations, very different from those of practice; and then the cost of manuring with these manures for a hectare becomes so high that they cannot be used. The following, in fact, are the cyphers which are obtained:—

	kilogr.	fr. c.	fr. c.
Poppy-cake	1771 at	12 0	212 50
Hemp	2000 ,,	12 50	250 0
Linseed	2066 ,,	15 50	320 0
Camelina	2226 ,,	12 75	283 80
Colza	2234 ,,	12 75	284 80
Beech	2755 ,,	6 00	165 30
Pistachio	3031 ,,	6 00	181 85
Sesamum		price not known	

It is evident that, with the exception of poppy, beech, and pistachio-cakes, the cost of manuring with which is inferior to that of manuring with farm-yard manure, all the others are much dearer than the latter. But these theoretical estimations are so far from that which practice has recognised as sufficient, that it is easy to comprehend, as well from this example as from that of poudrette (its practical estimation is, as we have seen, 1750 kilogrammes, and the theoretical estimation deduced from the richness in nitrogen is 6384 kilogrammes), that the mode of estimation adopted by MM. Boussingault and Payen does not lead to

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the truth; and this may be conceived when it is remarked that those chemists take no account, in either the cakes or poudrette, of the phosphates which predominate in them, and which are, as is well demonstrated, so active and so necessary to the vegetation of seed plants and cereals.

12. The other mode of turning cakes to advantage in farms, is to use them for the feeding and fattening of animals. Practice and theory concur in recognising a considerable nutritive value in these residues.

It is easy to comprehend why these cakes are so nutritious. All oleaginous seeds contain a considerable proportion of nitrogenous matter similar in its composition and property to the caseum of milk. Now the residue which comes out of the press, retains almost entirely this nitrogenous or animalised matter, which contains 16 per cent. of nitrogen, and whose quantity represents 42 per cent. of meat. In addition to this matter, which is so well adapted for the nutrition of animals, there is, also, in the cakes, from 10 to 12 per cent. of fatty matter which is quite ready for assimilation, and, finally, earthy phosphates, which serve for the increase of the osseous system.

Physiology teaches us that the alimentary ration best suited for the maintenance of an adult animal is that which contains at once the elements of the osseous system and the nitrogenous principle necessary for the formation of flesh. We find these two kinds of elements in the cakes. They also contain another which is likewise of great importance, namely, the fatty matter which serves, either directly for the formation of fat, or indirectly for the production of animal heat in the act of respiration. For all these reasons, these residues constiute one of the most advantageous aliments.

M. Boussingault has ascertained by experiment that there is always, industrially speaking, an advantage in giving to animals which are to be fattened, fatty matters ready formed, rather than food capable of producing them. Thus, the grain of linseed is preferable to its cake, and the latter is better than leguminous or forage plants for effecting a rapid and economical fattening. It is well known to every experienced practical man that roots, carrots, beet-roots, and potatoes fatten only when associated with products containing fatty bodies, such as straw, the seed of cereals, bran and cakes.

In the same way, it is conceived that for the production of milk, of which butter is the most important and the dearest portion, it is profitable to make fatty aliments predominate in the feeding of cows. And, indeed, cakes, associated with forage, and beet-roots increase the production of milk, and produce milk richer in butter.

The employment of cakes has this other advantage, that we can improve with them forages of inferior quality, which, being too poor in fatty principles, are not, of themselves susceptible of aiding in fattening or the maintenance of milk cows. In bad years, they may be substituted for forages and roots.

Practice, moreover, has not waited for theory, for the general use which has long been made of cakes in the nourishment of milk cows and for fattening animals, has demonstrated their nutritive qualities in the most positive manner.

13. The best mode of using the cakes is to steep them in tepid water, mixed with other aliments, husks, pods of farinaceous vegetables, refuse of colza, cabbages, potatoes, radishes, chopped straw and hay, bruised grain and bran, which are stewed or macerated in this water. We thus obtain what is called *sonpel*, which is poured into the mangers. The animals eat it with avidity.

In Flanders, they are given to cows under the form of thickened drinks, prepared by mixing them with brewer's dregs. As this mixture alters very rapidly, it is prepared only a few hours before being used.

In good agricultural establishments in the North of France, they give 500 grammes (about 1 lb. English) to a draught horse or laboring ox; 280 grammes of poppy cake, and 95 grammes of linseed cake to sheep in the sheep fold; to fattening cows, 500 grammes of poppy cake the first month, 1,000 the second, and 1,500 the third, independently of linseed meal and beans in the same proportion.

The introduction of cakes and even of oleaginous seeds into the alimentation of animals has rendered the fattening of cattle a methodical operation in England, Belgium, and in the North of France.

14. Practice considers linseed cakes as most nutritious. Their mucilaginous nature, their emollient property, and their ordinarily higher price, cause them to be employed more especially for beasts that are sick or ready to bring forth. They are preferred to all others for milk cows.

Colza cakes occupy the next drink. They are adapted, as well as rape cakes, for sheep attacked with the rot.

Hemp and beech cakes are much less esteemed, and they even become injurious when they are administered in large quantities. They cause diarrhœa.

M Grognier regards the cake of nuts as richest of all.

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The Colza, rape, camelina, and mustard cakes, being impregnated with the acrid principle of those plants, which resists to the action of the digestive forces, and which for that reason, is found in the excretions of the animals that have been treated with these cakes, have the inconvenience of communicating to the dung a caustic property which causes a slight disease in the feet of the beasts which stand in it. Fortunately, this disease is rapidly made to disappear very quickly by changing the diet and cleaning the stable, without any necessity for medical treatment.

Linseed, hemp, poppy, and pistachio cakes never produce ill effects on the feet of cattle.

15. If, now, relying on the chemical composition of cakes, we seek to establish their nutritive value taking as a term of comparison meadow hay, we arrive at the following results.

According to M. Boussingault, the ration of an ox should be per day 12 kilogrammes of dry hay, which contain 198 grammes of nitrogen and 84 grammes of bone phosphate.

To obtain the same quantities of these matters in each daily ration of cake, the following quantities of them must be given :—

	For nitrogen kil.	For bone phosphate kil.
Poppy cake.	1·970	1·330
Hemp ,,	2·225	1·185
Linseed ,,	2·300	1·710
Colza ,,	2·486	1·300
Sesamum ,,	2·477	2·025
Camelina ,,	2·477	2·000
Pistachio ,,	2·273	7·000
Beech ,,	3·066	4·000

By adopting the quantities based on the proportion of nitrogen, it is evident that with the cakes of poppy, linseed, hemp, colza, and camelina, the animals would receive a much greater proportion of phosphate than is necessary; it would be most nearly what it ought to be with sesamum cake; it would be one-fourth too little with that of beech, and three times as much as it should be in pistachio cake.

There can be no kind of inconvenience in the quantity of the phosphates being a little increased in the nourishment of the animal: the agriculturist will always find them in the manure; but perhaps it may be well to prove experimentally what is the influence on the health of the animal of too small a quantity of these salts, as in the case of beech cake and especially pistachio cake.

If we investigate what is the advantage, at the present time, in an economical point of view, derivable from the employment of cakes, we obtain the following data :—

12 kilogr. of dry hay, and luzerne, at 46 francs the thousand kilogr., cost 50.7 centimes.

The rations of cakes are all cheaper, as will be seen from the following table :—

	Centimes.
Linseed cake.....	34·6
Camelina ,, ...	32·6
Colza ,, ...	31·6
Hemp ,, ...	27·6
Poppy ,, ...	23·6
Beech ,, ...	18·0
Pistachio ,, ...	13·6
Sesamum ,, ...	price not known.

In this table, the pistachio cake is remarkable for the low cost of the daily ration. This circumstance gives great interest to the practical experiments which should be tried to ascertain if the small proportion of phosphate contained in this substance is without injurious influence on the nutrition of animals. If this point were put beyond doubt, pistachio-cake would acquire a degree of importance which would always be denied to it as a manure.

It is well to add that if the addition of salt to the cakes is always advantageous, it becomes indispensable in the case of pistachio-cake, which is so insipid, that the beasts refuse to eat it; but when it is properly salted, they eat it with as much pleasure as the others.

The quantities of cake which should be given to an animal, according to some agriculturists, are much higher than those which we have indicated, and which are based on theoretical considerations. Thus, M. Mathieu de Dombasle gives as the daily ration of linseed cake 6 kil. 840 grammes; Block 5 kil.; M. Bouscaren 6 kil. M. Perrault de Sotine employs 5 kil. 320 grammes of colza cake.

M. Bouscaren is the only one who distinctly says that he makes it the sole nourishment of his animals.* It is very probable that the others experimented in the same conditions, and it is that, doubtless, which has forced them to increase so much the proportions of the cakes. It may be conceived, indeed, that an herbivorous animal, whose stomach is of large capacity, cannot be nourished without inconvenience, by a substance which contains the nutritive matter of small bulk; whence arises the necessity of increasing the mass of the aliment, as

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well as the passing off of a portion of the alimentary matter without being used.

It will be understood that in the South of France, where forages, milk and butcher's meat are both rare and dear, and where it is often difficult to prevent beasts from dying of starvation, the exclusive use of cakes has rendered some service; but in the North, where forages are abundant, animals fed exclusively on cake will remain without buyers. This kind of nourishment gives inferior meat, oily fat and a disagreeable milk which furnishes very fluid butter.

Cakes must only be used associated in limited proportions with dry or fresh aliments, and their use must be stopped towards the end of the fattening, in order that the flesh may retain no extraneous flavor. Nevertheless, in proper proportions and with discretion, cakes will contribute, by varying the nourishment, to render nutrition more perfect in laboring animals, to keep up a good supply of milk, and to favor the fattening of animals.

Considering, in addition to this importance of cakes as alimentary substances, the advantages which, in certain circumstances, may be derived from them as manures, we cannot but desire to see them more generally used, and our agriculturists profiting by the example of the English and Belgians, who, as we said at the commencement of this paper, remove from our soil an enormous quantity of these useful matters.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in the separation and disinfection of fecal matters, and in the apparatus employed therein. JAMES HAMILTON BROWNE, of the Reform Club, Pall Mall, Esquire. (A communication.) Patent dated October 10, 1850.

This invention consists—*first*, in certain disinfecting agents; and, *second*, in the separation of the liquid from the solid matters contained in cesspools, &c., and in the filtration and clarification of such liquid matters, while the solid matters are thereby rendered applicable as manure.

The chemical disinfecting agents hitherto employed are very inefficient, and do not fulfil the desired object; for instance, the sulphate of peroxide of iron has been recommended as being a suitable agent for counteracting the disengagement of free sulphuretted hydrogen; now, by the use of this salt, the very evil sought to be remedied is rather increased, for in consequence of its acid nature, disengagement of large quantities of sulphuretted hydrogen and carbonic acid gases takes place, which causes a great deal of froth and scum to accumulate on the top of the matters acted on. Now the agents and processes which I use are as follows:—1. I combine with or neutralize phosphuretted hydrogen gases by means of the impure binoxide of tin, which may be purchased at a low price. 2. Or I employ the subsulphate of peroxide of iron, represented by the formula $SO^3 Fe^2 O^3 + 6 HO$, which does not contain an excess of acid, but on the contrary, being basic, as well as peroxidized, completely destroys the sulphuretted and phosphuretted hydrogen gases, and prevents froth and scum, the presence of which indicates a want of success in disinfecting operations; it also neutralizes the carbonic and hydrosulphate (sulphydrate) of ammonia, which are the only other gases arising from cesspools and such like receptacles.

3. Any neutral metallic salt may also be used to fix any gases other than free sulphuretted and phosphuretted hydrogen, and either the binoxide of tin or the subsulphate of peroxide of iron may be subsequently introduced to decompose the two gases just mentioned (carbonate and hydrosulphate of ammonia).

4. The saturation or neutralization of the before-named metallic salts may also be effected by the use of the ammoniacal water from gas-works.

5. By increasing the proportion of ammoniacal gas-water, the non-permanent carbonates and hydrated oxides of iron, of zinc, &c., would be precipitated, and thus a good disinfectant may also be obtained. A solid disinfecting agent, or one in a state of paste, may be made by mixing either the subsulphate of iron, or stannic acid, or oxichloride of tin, with some cheap oleaginous matter; three or four thousandth parts of this paste would be sufficient to neutralize or fix the fetid gases contained in the fecal matters.

6. Under the following circumstances the chloride of calcium (a residuum, now lost, resulting from the manufacture of bone gelatine) makes a good disinfectant, all excess of acid being neutralized either by lime or by ammoniacal gas liquor; the metallic salt is then to be added, when, by double decomposition, are produced sulphate of lime in a very divided state (which will fix the ammonia of the liquids) and neutral protochloride of iron very economically. Besides,

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The Colza, rape, camelina, and mustard cakes, being impregnated with the acrid principle of those plants, which resists to the action of the digestive forces, and which for that reason, is found in the excretions of the animals that have been treated with these cakes, have the inconvenience of communicating to the dung a caustic property which causes a slight disease in the feet of the beasts which stand in it. Fortunately, this disease is rapidly made to disappear very quickly by changing the diet and cleaning the stable, without any necessity for medical treatment.

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15. If, now, relying on the chemical composition of cakes, we seek to establish their nutritive value taking as a term of comparison meadow hay, we arrive at the following results.

According to M. Boussingault, the ration of an ox should be per day 12 kilogrammes of dry hay, which contain 138 grammes of nitrogen and 84 grammes of bone phosphate.

To obtain the same quantities of these matters in each daily ration of cake, the following quantities of them must be given :—

	For nitrogen kil.	For bone phosphate kil.
Poppy cake.	1·970	1·330
Hemp ,,	2·225	1·185
Linseed ,,	2·300	1·710
Colza ,,	2·486	1·300
Sessamum ,,	2·477	2·625
Camelina ,,	2·477	2·000
Pistachio ,,	2·273	7·000
Beech ,,	3·066	4·000

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Colza ,, ...	31· 6
Hemp ,, ...	27· 8
Poppy ,, ...	23· 6
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Pistachio ,, ...	13· 6
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The chemical disinfecting agents hitherto employed are very inefficient, and do not fulfil the desired object; for instance, the sulphate of peroxide of iron has been recommended as being a suitable agent for counteracting the disengagement of free sulphuretted hydrogen; now, by the use of this salt, the very evil sought to be remedied is rather increased, for in consequence of its acid nature, disengagement of large quantities of sulphuretted hydrogen and carbonic acid gases takes place, which causes a great deal of froth and scum to accumulate on the top of the matters acted on. Now the agents and processes which I use are as follows:—1. I combine with or neutralize phosphuretted hydrogen gases by means of the impure binoxide of tin, which may be purchased at a low price. 2. Or I employ the subsulphate of peroxide of iron, represented by the formula $SO^3\ Fe^2\ O^3 + 6\ HO$, which does not contain an excess of acid, but on the contrary, being basic, as well as peroxidized, completely destroys the sulphuretted and phosphuretted hydrogen gases, and prevents froth and scum, the presence of which indicates a want of success in disinfecting operations; it also neutralizes the carbonic and hydrosulphate (sulphydrate) of ammonia, which are the only other gases arising from cesspools and such like receptacles.

3. Any neutral metallic salt may also be used to fix any gases other than free sulphuretted and phosphuretted hydrogen, and either the binoxide of tin or the subsulphate of peroxide of iron may be subsequently introduced to decompose the two gases just mentioned (carbonate and hydrosulphate of ammonia).

4. The saturation or neutralization of the before-named metallic salts may also be effected by the use of the ammoniacal water from gas-works.

5. By increasing the proportion of ammoniacal gas-water, the non-permanent carbonates and hydrated oxides of iron, of zinc, &c., would be precipitated, and thus a good disinfectant may also be obtained. A solid disinfecting agent, or one in a state of paste, may be made by mixing either the subsulphate of iron, or stannic acid, or oxichloride of tin, with some cheap oleaginous matter; three or four thousandth parts of this paste would be sufficient to neutralize or fix the fetid gases contained in the fecal matters.

6. Under the following circumstances the chloride of calcium (a residuum, now lost, resulting from the manufacture of bone gelatine) makes a good disinfectant, all excess of acid being neutralized either by lime or by ammoniacal gas liquor; the metallic salt is then to be added, when, by double decomposition, are produced sulphate of lime in a very divided state (which will fix the ammonia of the liquids) and neutral protochloride of iron very economically. Besides,

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by the combination of those substances with the chloride of calcium, a deposit of phosphate of lime takes place, which increases to a great extent the richness of the matters operated on, when converted into manure.

7. The influence of oleaginous matters in the instantaneous disinfection of putrid matters, &c., has not been sufficiently studied, nor has the action of fatty bodies upon the sulphuretted hydrogen; a gas so much like, from its composition and chemical nature, if not from its physical qualities, to the carburets of hydrogen. For instance, it has always been supposed that common oil only tended to cover the surface of the matters, and thus as it were to imprison those gases so unhealthy and unpleasant to the smell; this is not going far enough, and it will be shown that the results produced have not been properly understood. Convinced of the highly disinfecting powers possessed by the carburets of hydrogen, the inventor has endeavoured to discover the means of turning their use to good account; a little reflection will show that oil and fatty matters have hitherto been used without any regard to economy; in fact, people have gone no further in many cases than to throw a few quarts of oil over the matters in cesspools, &c., a proceeding attendant with the following disadvantages:—First, the difference of specific gravity prevents a mixture taking place; and, second, the oil only covers the surface of the matters, and does not act at all on the lower part, therefore its action is incomplete. To overcome these disadvantages; first, the difference of specific gravity must be adjusted; and, second, the surface for the oily matters to act upon must be considerably increased.

The inventor makes an artificial disinfecting fluid, holding an oily substance in solution, and very finely divided, for which purpose some hundredth parts of oil or fatty substance are mixed with water, which, to facilitate union, should be made slightly alkaline, either by potassa, soda, or ammoniacal gas water, &c. After the fatty substances and water have been intimately mixed, a white, opalescent, and lactiform fluid will be produced; according to the quantity of oil or fat used will be the strength of the disinfecting liquor, therefore it is unnecessary to give an exact scale of proportions. In order the better to adjust the difference of specific gravity, it is preferable to use the lactiform fluid in combination with one of the salt solutions before described. The metallic salts will, of course, act, and wherever they penetrate, there the oily matter will go with them. If desirable to increase the density of the lactiform liquid without using the metallic salt, which causes a change in the color and appearance of the fecal matters, it is only necessary to substitute for the metallic salt a saline solution or chloride of calcium (residuum from the manufacture of gelatine from bones), which, being acid, requires to be first carefully neutralized. The chloride of calcium resulting from the manufacture of artificial soda would also answer the same purpose. The inventor also uses in some cases, together with the lactiform liquid, certain remains left from the manufacture of stearine, the liquid remaining from the washing and cleaning of wools, and the remains from the purification of oils, known as oil finings (*fèces d'huile*). This liquid may be used either alone or together with metallic or non-metallic salts.

8. Organic matters, while fermenting, are in a state of continual movement, resulting from the transformation of a portion of the solids and gases. In the transformation there is an absorption of heat, without which, therefore, neither fermentation nor putrefaction can take place. This motion of particles, due to fermentation and to the gases resulting therefrom, having a tendency to pass off, is more visible when the fermentable matters contain a quantity of liquid.

The inventor has discovered certain means of arresting this fermentation, and of hastening the precipitation of the matters held in suspension, so that they may be more readily separated. First, fermentation is arrested by the introduction of one or other of the disinfecting agents before described (other known disinfectants may also be employed for this purpose); and second, the precipitation and separation of the matters so treated are facilitated by the disinfectants before described. They generally produce a metallic sulphate, which, by its superior gravity, causes the more rapid descent of the organic matters held in suspension, which, in some cases, is effected in a few days, but more generally in a few hours. The liquids are then drawn off by any suitable apparatus, and if they cannot be dispersed over the fields, may be thrown away, while the remaining portions at the bottom of the receptacle are taken out to be immediately converted into inodorous manure.

Should the liquid extracted not have been allowed sufficient time to settle, and before being thrown away or placed into reservoirs, it is passed through a filter, preference being given to a filter formed of carbonaceous substances.

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To the pipe conveying the liquid into the filter, or that which takes it from the filter, a small tube communicating with the vessel on a higher level, and containing the disinfecting liquor, is connected, so that should the disinfectant not have penetrated everywhere, and have rendered the disinfection complete, it may thus be made perfect before the liquid is thrown away.

More rapid and perfect clarification or decantation may be effected by means of any compound of alumina, particularly the double sulphate of alumina and of potassa, or the impure sulphate of alumina.

9. The patentee finally describes an apparatus for disinfecting matters during their passage through the pipes, by which they are withdrawn from the depository.

By following the processes, one or other of them herein described, the after manufacture into manure is much more economical, much more rapid, and there will be much less loss of ammoniacal substances than by any other means hitherto adopted.

A mixture with some dry carbonaceous powder would ensure a rapid conversion (from fifteen days in summer to one month in winter) of fecal matters into a powdery and permanently inodorous substance.

Claims.—1. The separating of the liquid from the solid parts of fecal and putrid matters, and the disinfecting of fecal and putrid matters by means of any of the metallic salts before described, whether employed by themselves or in conjunction with the lactiform fluid before described.

2. The lactiform fluid before described, for the purpose of disinfecting fecal and putrid matters. And

3. The disinfecting of fecal matters while being withdrawn from a cesspool or other receptacle, by means of the apparatus before described.

Improved method of extracting silver from argentiferous minerals. ADOLPH FREDERICK GURLT, of Manchester, gentleman. Patent dated October 10, 1850.

Before proceeding to a description of his improvements, and in order to exhibit more clearly their distinctive peculiarities, the patentee alludes briefly to the principal methods hitherto employed to effect the same object. These are—

1. The eliquation process in which the argentiferous mineral is melted with lead, or a suitable combination of lead; the silver combines with the lead, owing to its great affinity for that metal, and is afterwards separated by cupellation, as is well understood.

2. The European method of amalgamation, in which a chloride of silver is formed by mixing common salt in a reverberatory furnace with the calcined ore or regulus, which chloride is then reduced to the metallic state by metallic iron, and dissolved in quicksilver, thus forming an amalgam, which is separated from the ore or regulus by washing processes, and afterwards deprived of its mercury by distillation, leaving the silver in a metallic state.

3. The American amalgamation process, in which calcined copper ore (magistral) and common salt are mixed with the material from which silver is to be extracted, and water added in sufficient quantity to produce a thick pasty mass. The chloride of silver thus formed is reduced to the metallic state by iron, and dissolved in mercury, producing an amalgam which is subsequently treated in the same manner as that obtained by the European method of procedure.

4. A method in which a chloride of silver is formed in a reverberatory furnace, as in the European method, dissolved in a hot concentrated solution of common salt, hyposulphate of soda, or other suitable agent capable of dissolving the chloride of silver, and separated from the insoluble matters by filtration, metallic silver being obtained by means of any suitable metal.

5. Another method in which all the sulphuret of silver contained in the ore is converted by calcination into a sulphate, which is dissolved in boiling water, and metallic silver precipitated by the ordinary means.

The patentee's method differs from all of these, and consists in subjecting the ore containing sulphuret of silver to the direct action of a concentrated solution of common salt, or its chemical substitutes, such as chloride of potassium, ammonium, &c., in combination with chloride of copper, iron, zinc, &c., by which the sulphuret of silver will be converted into chloride of silver, and dissolved in its nascent state (any native chloride, *e.g.* horn silver—being also dissolved at the same time), from which solution metallic silver may be obtained by means of suitable metals.

In carrying the invention into effect, a mixture is prepared containing 100 parts of a concentrated solution of alkaline or earthy chloride to 10 parts of the metallic chloride, and heat applied till the temperature of the solution is raised to about 200° Fahr., in which state it is fit for use. The argentiferous substance to be operated on, whether ore of copper, iron, zinc, &c., or regulus, is to be reduced to a fine powder, in order to facilitate the lixiviating process. When the gangue of the or consists of carbonates or

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oxides of lime, magnesium, barium, strontium, &c., which would act prejudicially on the metallic chlorides, and convert them into hydrates or oxides, it must be smelted before lixiviation, so as to reduce the noxious matters to slag and the metals to regulus. Should it, however, not be desirable in other respects to perform this operation, the ore must be immersed in dilute muriatic or sulphuric acid, which will, in a great measure, produce an analogous effect. The operation of lixiviation is effected in revolving casks, such as are used in amalgamation works. These are charged according to their size with the solution and argentiferous substance, the former in the proportion of three times the volume of the latter, and both heated to about 200° Fahr. previous to their introduction, except where means exist of applying steam or other heat during the process. The cask is then set in agitation, and at the expiration of a stated time, varying with the quantity of ore and the amount of silver contained in it, the solution is tapped off, a fresh supply introduced, and this operation repeated till all the silver is supposed to be extracted. For a charge of 5 cwts. of ore the average time occupied is twelve hours, the solution being changed three times during this period. On its withdrawal from the cask, the ore or regulus is to be washed in some of the solution to remove any chloride of silver that might be adhering to it, and which would otherwise be lost. In order to obtain metallic silver from the solution holding the chloride in suspension, the patentee prefers to employ the metal whose chloride has been used in making the solution, as in this case a new chloride will be produced equal to the quantity of silver precipitated, and the liquor may be then used in a succeeding operation. He also employs in making the solution a chloride of that metal which predominates in the ore. When the ore contains, in addition to the sulphuret and chloride, metallic silver, but not in sufficient quantity to be worth mechanical extraction, it is recommended to smelt the ore previous to lixiviation, so as to reduce all the silver contained in it to the state of a sulphuret. The chlorides which the patentee prefers as being the cheapest, are those of sodium (common salt) and iron; he employs also in addition to those above enumerated the chloride of lime.

Claim.—The use of a combined solution of the chlorides of potassium, sodium, ammonium, &c., and the chlorides of iron, copper, zinc, &c., for the purpose of extracting silver from argentiferous minerals.

Improvements in the manufacture of iron and other metals. HENRY HOULDSWORTH, of Cottage House, Lanark, iron-master. Patent dated September 26, 1850.

The improvements here claimed are—

1. The application of the inflammable gases evolved from blast furnaces in the process of smelting to the roasting or calcination of iron, stone, and other ores of metal and lime.

2. The system of roasting or calcining minerals by such gases conducted through pipes or flues to close kilns or deposits of the minerals, and ignited therein.

3. The application of these gases to the purpose of drying cores or moulds, or other similar apparatus employed in the casting of metals.

4. The system of blowing smelting or melting furnaces, or fires employed in the manufacture of metals by means of air blasts diffused over a large surface of the mineral under operation, either by two or more currents of air impinging one against the other, or by a current of air impinging against a fixed deflecting surface.

5. The employment of annular tuyeres or blowpipes for the purpose of diffusing the air blast.

Improvements in the preparation of peat, and in the manufacture of the same into fuel and charcoal. JASPER WHEELER ROGERS, of Dublin, civil engineer. Patent dated September 19, 1850.

The improvements here claimed have relation to a method of economizing the refuse of bogs, and dust, and mould, or "mull" of peat, and converting them into fuel or charcoal. The different waste portions are well mixed in a pug-mill, or by any suitable apparatus, after which they are fed into a trough, supported inside of an air-chamber over the carbonizing furnaces, by which it is thus considerably heated. A furnace is placed at the end of the air-chamber, and the products of combustion playing around it further increase the heat. A screw is placed in the interior of the trough, for causing the peat to pass from end to end of it. The peat when delivered from the trough is in an incandescent state, and in order to cool it, it is passed directly into a cylinder revolving in a tank partially filled with water, and the ends of which are conical, to admit of the body of the cylinder coming under the cooling influence of the water, without any danger of its getting admitted into the cylinder. The cooled and carbonized peat is delivered into a sack, or other suitable receptacle, by means of a screw thread in the interior of the cylinder.

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A method of preventing the admission of air to the carbonizing furnaces is next described. A tank-shaped recess is formed for these furnaces, which are mounted on wheels to admit of their being run in under the air-chamber, and water is admitted into this tank until it reaches a little above the bottom of the furnaces, and thus effectually exclude the air.

Improvements in the manufacture of soap.

WILLIAM TUDOR MABLEY, of Manchester, patent agent. Patent dated October 3, 1850.

The object of this invention is to produce, from crude turpentine, a resin soap, which may be used either in combination with grease soap or alone.

The inventor first melts, by steam or otherwise, 1000 parts of crude turpentine, and adds to this 400 parts of a solution of soda containing 33 per cent. of pure dry soda. The effect of this is to neutralize the natural acids, and set free the essential oil contained in the turpentine. In order to separate the latter, a solution of common salt in water is added to the saponaceous mass, and the vessel containing it connected with a condensing apparatus, such as is used by distillers of spirits of turpentine. Heat is then applied, and the essential oil driven off with the steam which rises from the mixture, and condensed in the condensing apparatus. The soap will be found floating on the surface of the saline solution. The inventor prefers to use this latter, as being of greater specific gravity than water, and equally well adapted for producing steam. It is not, however, essentially necessary. Another method, which has been found to answer well, is to use a ley of less strength than that above mentioned—say about 20° Beaumé—half of the necessary quantity only being at first added to the melted turpentine, and the remainder introduced during the process of distillation in a ratio equal to the quantity of spirit and water that comes over in the still. A solution of soda ash in water may also be used; but great care is requisite under these circumstances, carbonic acid gas being produced in large quantities during the process. (One pound of soda, caustic or carbonated, containing 50 per cent. of pure soda, is sufficient to saponify four pounds of turpentine.) In order to remove any coloring matter which may be extracted from the turpentine, the soap is to be washed in a solution of salt and water. The resin soap thus produced is suitable for use alone, or may be combined with grease soap of any kind. A good light-colored article may be made by mixing 100 lbs. of good grease soap with 200 lbs. of the resin soap produced as above. The spirit of turpentine which results from this distillation is rather different from that produced by the ordinary processes. It is well adapted for burning in lamps, as it gives a bright flame and leaves no residuum.

Claims.—1. The making of resin soap from crude turpentine, without the use of tallow, fat, or grease.

2. Distilling the essential oil of turpentine, as above described, to form soap.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THERAPEUTICAL EMPLOYMENT OF SULPHUR IN THE BROWN AND VISCID STATE.*

BY DR. HANNON.

DR. HANNON, a Belgian physician, has recently published a work in which he recommends the brown sulphur obtained by fusion or precipitation, and which, according to him, has all the qualities of yellow or solid sulphur, but possesses much greater energy. Brown and viscid sulphur is a more energetic and more prompt stimulant than yellow and solid sulphur; it succeeds much better in all the various affections in which ordinary sulphur is customarily prescribed. It rapidly excites all the organs and especially the skin, lungs, and circulatory apparatus. It has all the activity of the alkaline sulphurets, and has not their inconveniences: it has not, like them, that repugnant odor, that causticity, and that facility of oxidation which renders them unworthy of confidence and dangerous, &c. Such are the reasons which Dr. Hannon gives for substituting brown and viscid sulphur for ordinary sulphur. As to the means of obtaining this medicament, they are of several kinds:—by precipitation and by fusion.

He points out two processes of precipitation. The first consists in making a mixture of two parts of nitrate of potassa and two parts of chloride of sodium, to which

* *Presse Medicale Belge.*

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he adds one part of sulphuret of copper obtained directly or by precipitation: then sulphuric acid is poured on the whole until effervescence ceases: viscid sulphur is then formed, which floats on the surface of the liquid under the form of globules, varying in size.

During the reaction, aqua regia is formed, which reacts on the sulphuret of copper, converting it into chloride and liberating the sulphur. If the sulphuric acid is in excess, hydrochloric acid and sulphuret of copper are formed, which in no way injure the operation as regards either the quantity or the quality of the viscid sulphur obtained.

The second process, which is still more simple, consists in treating sulphuret of copper directly by aqua regia. The latter is added until the whole of the copper is dissolved and converted into chloride.

This viscid sulphur, thus obtained, is washed and collected on a filter. It may also be obtained by fusion by the following process.

The sulphur, which enters into fusion at 226° F., if the heat be continued, remains yellow up to 284° F., and if it then be cooled, it returns to what it was before the operation; but if the temperature be raised still higher, and until it reaches 320° F., it becomes brown and viscid; at 482° F. it becomes black and loses its fluidity; in this state, if it be placed under water, it remains for a long time in the pasty state and retains its deep color, especially when it is left for half an hour at the temperature of 482° F. In this state it resembles gutta percha softened by boiling water, and may take all forms; nothing is more easy, consequently, than to give it any shape and to make it into pills.

Brown sulphur is administered internally in various doses according to the effect which it is desired to be obtained. Externally, it may, like yellow sulphur, be employed under the form of pommades, ointments, &c., in the treatment of itch and dartres. It should never be employed as a purgative; yellow sulphur is far preferable to it, since it is less attackable in the digestive tube and less exciting.

The true indication for the employment of brown sulphur is to administer it as a stimulant; it is then advisable to prescribe it in pills of 10 centigrammes each, of which the patient takes 3 or 4 per day, which is nearly equivalent to 1 gramme of yellow sulphur. The brown sulphur obtained by precipitation by means of aqua regia which is made to react directly on the sulphuret of copper is the most active, and should not be prescribed in doses exceeding 20 centigrammes per day. The yellow and solid sulphur, and the brown and viscid sulphur, are two allotropic states of the same body; they have in these two states, whilst retaining the same chemical composition, different physical and therapeutical qualities.

In order to be able to depend on the efficacy of the brown sulphur, it is necessary to employ only recent preparations; for at the end of a certain time, it becomes hard, brittle and yellow; its density is raised to 2·05, and in this state no longer possesses any other properties than those of ordinary sulphur.

Such is, in substance, a summary of Dr. Hannon's work on the properties and mode of preparation of viscid brown sulphur. As to the doses and mode of administration, he gives the following recommendations.

Internally, either the precipitated brown sulphur, or that obtained by fusion, may be administered.

It is advisable, in the first case, to mix the brown sulphur with balsam of tolu, which possesses the property of preserving the sulphur sufficiently long in that particular state in which we recommend it. In the second case, namely, when sulphur obtained by fusion is employed, it is sufficient simply to make pills according to the ordinary process employed by pharmaciens for dividing pillular masses. As a diaphoretic, the precipitated brown sulphur is prescribed in the dose of 25 centigrammes to 1 gramme; the sulphur obtained by fusion in the dose of 1 gramme to 2·50 grammes.

PILLS OF PRECIPITATED BROWN SULPHUR.

℞ Precipitated brown sulphur 8 grammes.
Balsam of Tolu..... q. s.

To make secundum artem pills of 20 centigrammes each.

Each pill contains about 17 centigrammes of sulphur. From 2 to 4 are prescribed per day in chronic eczema, squamous affections, psoral affections and chronic bronchitis.

PILLS OF BROWN SULPHUR OBTAINED BY FUSION.

℞ Brown sulphur obtained by fusion..... 8 grammes.

Divide secundum artem into pills of 20 centigrammes each.

The dose is from 6 to 10 per day. They are prescribed in the same cases as the foregoing. These two preparations may replace all other modes of administering sulphur internally.

2. Externally, precipitated brown sulphur should be employed in preference to the brown sulphur obtained by fusion, when

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it is required to administer it in ointment or pommade.

It has a very vivid action on the skin, much more so than that of yellow sulphur.

CERATE OF PRECIPITATED BROWN SULPHUR.

R Precipitated brown sulphur	2 grammes.
Simple cerate	8 ,,
Balsam of Tolu.....	15 decigrms.

To be employed in frictions in diseases of the skin.

POMMADE OF PRECIPITATED BROWN SULPHUR.

R Precipitated brown sulphur	8 grammes.
Balsam of Tolu.....	2 ,,
Lard	32 ,,

F.S.A. a pommade for the above-mentioned uses.

Such are the formulæ recommended by Dr. Hannon, and which, according to him, may replace with advantage all the other preparations of sulphur, both internally and externally.

ON THE DETECTION OF ARSENIC, APPLIED TO MEDICAL JURISPRUDENCE.*

BY M. A. MORIN.

A CASE of poisoning by arsenic led me to a series of researches whose results, although negative, are not quite void of interest.

The portions of the body, examined by Marsh's process, modified according to the process of the Academy of Sciences, produced an abundant arsenical sublimate, whilst the earth, supposed to be impregnated with the vomited liquid, gave no trace of it.

The analysts, in separating, received from the *juge d' instruction*, an order to take away a portion of the earth, and subject it to another examination. I soon received from one of them an opinion that it was not free from arsenic. I resumed the analysis, confining myself to carbonising the vegetable matters by sulphuric acid. Obtaining nothing by this means, I repeated the experiments by finishing the carbonisation with a mixture of hydrochloric and nitric acids, as is done for animal matters, and this time I collected some arsenical stains.

These two acids, tried before the investigation, had appeared pure; but the observation which I had just made gave rise to doubts in my mind in that respect. In employing in reactions the residue of a large portion of hydrochloric acid, I ascertained that it contained arsenic.

As we had made use of the same acid in the carbonisation of the matters reported on, this circumstance was sufficient in our opinion to weaken the conclusions of our report. Consequently, although our doubts as to the source of the arsenic which we had collected were very slight, we did not hesitate to submit them to the judge, asking for a fresh quantity, which was granted to us. This time, we used only sulphuric acid for the carbonisation of the animal matters, and the results we obtained were conformable to the first, namely: presence of arsenic in the body and absence of it in the earth.

Being rendered easy as to the principal fact, I devoted myself to the examination of the reagents employed in the detection of the arsenic.

The first I examined was the hydrochloric acid. I obtained some reputed pure from several laboratories, and found, with few exceptions, traces of arsenic.

Since there are so many chances of impurity, this is reason sufficient for avoiding the use, in an operation so important as the carbonisation of animal matters, the two acids used for forming *aqua regia*, and to confine ourselves to the use of sulphuric acid, which will succeed very well alone.

This observation concerning hydrochloric acid led me to examine various qualities of salt employed in food. I tried those of Montier in Savoy, of Bex, of Salins, and sea salt. With each kind, I accumulated in the same tube the result of a series of operations, whose total duration was about 20 hours. The salt of Salins produced a ring with a metallic lustre, volatile by heat. I obtained nothing like this with the others, or at least infinitely smaller quantities.

The appearance of the ring was so similar to that of arsenic that I had no doubt as to its identity with that metal, until I had submitted it to the test of reagents. The nitric solution, evaporated and redissolved in water, did not produce with nitrate of silver the brick-colored precipitate, a character of arsenic; and although that which I obtained had a slight reddish tint, it was not sufficiently distinct for the presence of that metal to be deduced from it. The substance extracted must therefore be classed among the bodies simulating arsenic.

Feeling persuaded that the ring which I had obtained from the salt of Salins was

* *Journal de Pharmacie*, Feb. 1851.

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indeed arsenical, I undertook simultaneously the detection of this poison in human urine, thinking that it would have accompanied the chloride of sodium consumed with the food, that it would be rejected with it, if it was not normal arsenic, in the sense which M. Orfila attached to that expression, there might at least be some of it habitually in the body of persons who had made use of arseniferous salt.

Considerable quantities of urine, evaporated and slightly carbonised by sulphuric acid, furnished with Marsh's apparatus a ring of metallic appearance, removable by heat, but which was nothing but the phosphuretted matter of MM. Danger and Flaudin.

These experiments are completely in accordance with those of those chemists, and with the conclusions of the commission instructed by the Academy to examine the question of normal arsenic. I mention them here, not that the judgment of the Academy needs confirmation, but that others may not experience the uncertainties that I have felt.

As to zinc and sulphuric acid, they may be obtained perfectly pure. I have, however remarked, as others doubtless have done, that after having continued a disengagement of hydrogen for several hours, a metallic stain has suddenly appeared in the tube, but isolated, and not followed by any other, as if an arsenical molecule, loralised in a particle of zinc, were liberated and carried away.

When the zinc and sulphuric acid are pure and the matters submitted to analysis contain arsenic, the operation proceeds very differently. The metallic deposit shows itself from the commencement and gradually increases in the tube without interruption, so long as the subatance is capable of furnishing it.

These facts show that it would be imprudent to conclude that there has been voluntary or accidental poisoning from the appearance of a few isolated arsenical stains, in an operation continued for several hours. This observation is so much the more important as the analyst is continually called upon to put himself on his guard against preconceived ideas and the too general tendency of the human mind to regard the accused as guilty.

TANNATE OF LEAD.*

BY M. ANGILLIS MORTIER.

I DISSOLVED on the one hand 16 grammes of pure tannin in 500 grammes of distilled water, 20 grammes of crystallised acetate of lead, not efflorescent and very dry, in equal quantities of water; having filtered the two solutions, I poured the lead solution into the tannic solution, until the supernatant liquor tried by iodide of potass no longer produced the yellow precipitate of iodide of lead, and by sulphate of peroxide of iron, no more precipitate of violet blue of tannate of peroxide, of the same base.

Being thus assured that all the tannic acid was transformed into neutral tannate of lead, I allowed the precipitate to sink, then decanted the supernatant water, and washed the tannate with distilled water. After some hours of repose I again decanted the washing water, drained the produce through a fine linen cloth, pressed firmly between blotting paper several times doubled.

I judged this precaution to be necessary, for experience apprised me in my preceding researches that if we expose tannate of lead to a moderate heat, in a very short time it becomes brown, while if dessicated rapidly, at a lower temperature, it remains of a dirty yellowish white.

After having weighed the remainder of the saturnine solution with great care, I have concluded that the 16 grammes of tannic acid having required for their transformation into neutral tannate 14 grammes 25 centigrammes of salt of lead, in solution in water, which leads me to admit for the formula of its preparation, the following proportion:—

℞ Tannic acid (dissolved in water)	16 grammes.
Acetate of lead	14¼ „

In forming this mixture, and acting as above, we obtain a very abundant flaky precipitate, of a dirty white while in a humid state, and taking by washing and dessication a yellowish green tint, inodorous, insoluble in water, weighing in round numbers about 24 grammes.

* *J. ph. d'anvers.*

TISSOT'S PURGATIVE POWDER.*

Jalap	equal parts
Rhubarb	
Senna	
Soluble cream of tartar	

Make a homogeneous powder.

Dose: from 2 to 6 grammes.

This powder, the receipt for which will not be found in the formularies, has been employed by practitioners in some of the localities of Normandy.

* *Bulletin therapeutique.*

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ON THE COMMUNICABILITY OF GONORRHŒA, IN REFERENCE TO MEDICAL JURISPRUDENCE.*

BY DR. BURKE RYAN.

Dr. B. Ryan was called on the 15th of the present month to examine two children, sisters, aged respectively one and four years. He found both labouring under a profuse puriform discharge, on the elder child of a fortnight's duration, in the younger of nine days. There was much fever; the parts, particularly in the elder, much swollen, and both suffered great pain in passing water.

The mother had no notion of the nature of the affection until an old woman, calling accidentally, told her the children were diseased. The explanation soon followed. A young woman in the house labored under profuse gonorrhœal discharge, as the mother of the child saw by her linen. This young woman was observed washing herself in the same vessel used for washing the children, and using the same sponge to her private parts as was used for them.

Had there been but one child, Dr. R. remarked he might have passed it over as an ordinary, yet aggravated, case of vaginal discharge in a child; but as there were two consecutively affected sisters, of this tender age, with the infection's cause so easily traceable, he thought it worthy of record, and endeavoured to make it as plain as possible by further enquiry. He therefore saw the young woman. She had gonorrhœa, under which she laboured during the last two months, using no means for curing it. She said she *did* use the children's sponge, as mentioned, but thought it more probable that the eldest child having sat upon the same vessel as herself, to pass water, was thus infected, and that the second took it from the sponge used for both. Some of the discharge was taken from *each of the three*, and the valuable assistance of Mr. Quekett sought for. He examined them under a magnifying power of 500 diameters. In that from the children there was scarcely anything but pus globules, thick and well defined. The discharge from the young woman, in whom the disease had been wearing itself out during two months, was of a more sanious character. There was epithelium in abundance; a few mucous, and also pus globules, diffused, but occasionally more aggregated.

Mr. B. Ryan remarked on the paucity of well recorded cases of this nature given by elementary writers. Indeed, some of our best authors say that gonorrhœa is communicated by impure connection, and there leave the matter. Thus, Cooper says, "From the manner in which the disease is contracted," &c. Liston:—"That people come with all sorts of stories—as of water-closets." &c. Forsyth speaks of it as a disease "after impure coition." Beck, speaking of vaginal discharges in children, where strong suspicions were entertained by a third party, of the discharge being gonorrhœal, bestows not the least attention in pointing out how the disease may be contracted in the manner above related, and how, consequently, undeserved suspicion may attach to an innocent person, to be followed perhaps, as heretofore, by punishment. And Taylor, in giving, as one of the four sources of evidence of rape, the existence of gonorrhœa, adds shortly after:—"If the child be laboring under syphilis or gonorrhœa, this is positive evidence of impure intercourse either with the reputed or some other person."

Now, in the cause of humanity Dr. Burke Ryan considered it our duty in such cases as these to take care that no innocent person suffered, for had this disease not been so easily traced to its source, or that there had been any suspicion of foul play from lads or men who had access to the children, or had the character of the inflammation, instead of the red and sthenic, partaken of the epidemic form, with its deep colored appearance and dark tints, bespeaking signs of violence, as spoken of by Lawrence and others, then the same fate might perchance befall the suspected individual as befell the boy whom Beck mentions as having been condemned to die on account of the death of Jane Hampden, aged four, who, from a vaginal discharge, died in a few days, having slept in the same bed with the boy. The surgeon on whose evidence he was condemned soon had reason to believe the child had fallen a victim to an epidemic. Or, suspicion might be awakened as in the parents of two children, one aged four and the other six, mentioned by Capuron, where they declared violence had been used. The mother of the children in the present case, while agitated extremely, was yet thankful that it was not to her own person she had applied the sponge, as in such case nothing could ever clear her with her husband. As many well authenticated cases as possible should be placed on record. There is no reason why people should not contract disease from the seats of water-closets, and in the case of a virtuous and truthful woman who labors under gonor-

* Read before the Medical Society of London, 10th April, 1851.

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rhœa; and yet denies having had improper connection, it would be a painful thing, and repugnant to all feelings of charity, not to give her the benefit of a doubt. Her after happiness might depend on our decision, and we should well weigh the *pros* and *cons* before giving an adverse opinion.

CASE OF POISONING BY CHLOROFORM.*

COMMUNICATED BY ALFRED S. TAYLOR, M.D., F.R.S.

Our experience is as yet very limited respecting the action of chloroform, as a liquid, in large doses. Mr. H. Jackson, of Sheffield, has kindly communicated to me the subjoined case, the details of which will be found to possess great interest. It is remarkable on the following grounds:—1st. That a very large dose of chloroform (*four ounces*) was swallowed by the patient. 2. That the individual, although he had lost all recollection of his movements, was capable of walking and exerting himself for at least an hour after swallowing the chloroform. 3. That the symptoms produced by chloroform as a *liquid* are not those of anæsthesia, but closely resemble the effects of alcoholic poisoning.—That chloroform as a liquid is removed with great rapidity from the stomach, partly by absorption, and partly, perhaps, by the passage of the liquid into the bowels. No chloroform was found in the stomach four hours after this large dose had been swallowed. The case further proves that liquid chloroform cannot be regarded as an active poison, and that as a noxious agent it is far more potent when applied in the state of vapor to the pulmonary surface than when introduced as a liquid into the stomach.

Mr. Jackson has suggested the question whether it be possible for a person to drink such a quantity of chloroform from a bottle. There appears to be nothing to shake the correctness of the boy's statement, and, medically, the question resolves itself into this—whether the vapor respired during the act of deglutition would suffice to produce insensibility and loss of power in a shorter period of time than that necessary for the completion of the act of deglutition. There is no reason to suppose that the vapor would incapacitate a person from swallowing four ounces under such circumstances; and as the patient could have had no motive for untruly describing the circumstances, there appears to me to be no medical reason for rejecting his statement as untrue.

About two o'clock, on Friday afternoon, a young man, æt. 22, apparently in a state of intoxication, entered the shop of a barber, in Gibraltar-street, and laid himself down on a bench, where he fell asleep. Until about 4 P.M. no notice was taken of him, but at that hour the master of the shop became alarmed, and sent for a surgeon. Mr. Gleadall soon arrived, and found him in a state of coma. The skin was much below the natural temperature; pupils much dilated, and insensible to light; respiration tranquil; pulse 65, small; the breath strongly impregnated with the odour of chloroform. An empty four-ounce bottle, which had contained chloroform, was found in his pocket. No treatment had been adopted except that of sprinkling cold water over the face.

Mr. Gleadall immediately introduced the tube of the stomach-pump, and washed out the stomach very freely with warm water in the first place, and then with brandy and water, and finally introduced one drachm of compound spirit of ammonia, which was in a short time vomited, together with a quantity of food which had been taken in the early part of the day.

The coma now became more profound; the breathing stertorous and puffing; the skin cold; pulse imperceptible; and there were general convulsions.

He was removed to the hospital of the poorhouse, and about 11 P.M. was seen by the surgeon, Mr. Skinner, who found him in an extreme case of collapse; comatose, and very pale; skin cold; the pupils acting very irregularly, sometimes much dilated, at others much contracted, breathing stertorous and puffing, and a frothy expectoration was expelled convulsively; sibilant rhonchus over the *whole* of the chest; pulse not more than 50, very feeble, and compressible; slight convulsive shiverings; the breath strongly impregnated with chloroform.

He was placed in bed, wrapped in blankets, and surrounded with tins of hot water. A large sinapism was applied to the chest, and a blister to the nape of the neck. He gradually recovered, and about 2 A.M. became sensible. A mixture of ammonia was ordered.

On Saturday morning, at 11 o'clock, he was complaining greatly of pain in the head; the conjunctive very much congested; the skin hot; respiration easy; pulse 90, soft; tongue red, and the papillæ

* Read to the Sheffield Medical Society, March 21, 1851.—*Medical Gazette.*

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raised. A slight diffluent rhochus was detected over the whole extent of the chest, and the heart sounds were roughened. He was ordered to take the powder of chalk, mercury, and rhubarb, and the saline mixture.

On Sunday much improved; the abnormal sound of lungs and heart gone.

On Monday he was much better, and on Tuesday he was discharged.

From the account given by him, it appeared that about one o'clock on Friday, when opposite the New Barracks, about a mile from the barber's shop, he drank four ounces of chloroform, which he had taken from his master's surgery (an ounce bottle of hydrocyanic acid was found in his pocket), and from that time he had no recollection of anything until he found himself in the hospital of the poorhouse, not even of having gone into the barber's shop.

THE EXHALATION OF CARBONIC ACID.*

The following summary of Scharling's important experiments on the exhalation of carbonic acid is given by Scherer:—The carbonic acid was estimated by a very perfectly contrived apparatus. A man of thirty years old was found to exhale, when remaining quiet, 12·06 grammes of carbon per hour. The same man, wielding violently a heavy iron-rod, and perspiring profusely, exhaled as much as 42·2 grammes of carbon per hour. An immense increased development of carbonic acid occurs, therefore, during exercise. In two experiments with tipplers, who had taken brandy just before, the quantity of carbon was 7·045 and 10·83 grammes. In the last case, however, the individual was in exercise. Scharling also found (with Dulong and Despretz, Regnault, and Reisedt,) a greater consumption of oxygen than was accounted for by the carbonic acid, viz., over a fourth part.

CASE OF POISONING BY LAUDANUM RESULTING FROM A MISTAKE IN A PHYSICIAN'S PRESCRIPTION.†

A case which has caused much sensation among the profession at Paris, was lately tried before the tribunal correctionel. The facts are briefly these:—In October, 1850, a Mr. Labbé, a post-master at Alfort, near Paris, was attended for a severe indisposition, by Dr. Deguise, a highly respected practitioner of the French capital. In the course of the treatment, Dr. Deguise prescribed an injection with laudanum, and instead of writing *ten drops*, wrote *ten grammes*. (The gramme is equivalent to about fifteen grains.) The patient was soon afterwards thrown into a comatose state; but by proper treatment was completely roused, and remained quite conscious, and free from narcotic symptoms, for twenty hours. After this period he, however, suddenly grew worse, and died two days after the injection had been administered.

The authorities appointed three commissioners, Messrs. Cruveilhier, Devergie, and Rayer, to investigate the matter. The result of the inquiry was, that the commissioners were of opinion, that the patient had died of a low fever, *complicated* by an overdose of laudanum. The court, not seeing in this answer whether the death had resulted from the imprudence of the medical attendant or not, disregarded the verdict of the commissioners, (without ordering a post-mortem examination,) and put Dr. Deguise on his trial. The most eminent men of the faculty were examined, among whom was Orfila, the points of interest being the quantity of laudanum injected, and the period (twenty hours) during which lucidity had been regained. The medical testimony was mainly in support of the commissioners' opinion, but the court found the accused guilty of *homicide by imprudence*, and fined him *twenty* pounds with costs, and sentenced him to 15 days imprisonment. The laudanum used was the preparation which goes by the name of Sydenham's laudanum, or compound opium-wine of the Parisian codex. We shall just transcribe its composition: Opium, two ounces; saffron, one ounce; cinnamon and cloves, of each, one drachm; malaga wine, one pound. Twenty drops contain one grain of opium.

POISONOUS EFFECTS FROM USING NEW EARTHENWARE.*

A somewhat singular, though not unaccountable occurrence, took place in the family of a gentleman in one of our neighbouring towns a short time since. It appears there was a large number of the gentleman's family and connections present to partake of a Thanksgiving-dinner, numbering in all twenty-three persons. The usual variety served on such occasions covered

* *Canstatt's Jahres-Bericht.*

† *Lancet.*

* *Medical Gazette.*

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the banquet-board, and the party partook of it with the proper relish. Twenty of this party remained over night, and took breakfast with their host the ensuing morning. A large chicken pie, which had not been touched the day before, was served out to them at this time. In a few hours after, seventeen of them were violently attacked with severe griping pains in the bowels, accompanied with profuse diarrhœa. It appeared, from investigation, that *only those who ate of the pie* were the persons who suffered. The lady of the house having made it herself, and partaken freely of it, suffering alike with the rest, of course removed all suspicion of intentional poisoning. The query now is, what was there in this *pie*, or about it, that should produce these effects? The pie was baked in a yellow earthen glazed dish that had never been used before; and the conclusion necessarily is, that its contents became impregnated with portion of the enamel with which it was lined; and hence the consequences. Now the enamel used by potters varies in composition according to the purposes for which the ware is intended. They all, we believe, contain more or less lead, cobalt, &c. Often the biscuit, as it is called, is made of clay which contains poisonous matter in various proportions; and if, after the baking, the vessels are imperfectly glazed or protected, bad consequences may arise from using them. All such ware to be used in cooking, when *new*, should first be proved, and this is best done by having it greased over with lard or tallow, and then subjected to the heat of an oven. This will generally be found a sure protection. This one instance should serve as a warning to families, and is not without interest to the physician. Had the occurrence taken place during the prevalence of cholera, the sickness might have been taken for it, and with very good reasons, its symptoms and character simulating that disease. We are pleased to state that the parties entirely recovered, the majority of them only suffering five or six hours.—*Boston Journal*, January.

*** It may be proper to state that some description of white glaze for iron vessels sold in our shops have been found to contain arsenic.

A BILL, INTITULED "AN ACT TO REGULATE THE SALE OF ARSENIC."

WHEREAS the unrestricted sale of arsenic facilitates the commission of crime: be it enacted by the Queen's most Excellent Majesty; by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:

ON EVERY SALE OF ARSENIC PARTICULARS OF SALE TO BE ENTERED BY SELL.

I. Every person who shall sell any arsenic shall forthwith, and before the delivery of such arsenic to the purchaser, enter or cause to be entered in a fair and regular manner, in a book or books to be kept by such person for that purpose, a statement of such sale, with the quantity of arsenic so sold, and the purpose for which such arsenic is required or stated to be required, and the day of the month and year on which, and the name of the person to whom, such arsenic is sold, and the name of the town or other place, and also the name of the street, square, road, lane, alley, or other like locality, and number of the house, if the same be said to be numbered, where such person shall abide, and whether such person is a lodger in or the keeper of such house, by using the letter "L" if a lodger, and the letter "H" if a housekeeper; into all which circumstances the person selling such arsenic is hereby required and authorized to inquire of the purchaser before the delivery to such purchaser of the arsenic sold; and such entries shall in every case be signed by the person making the same, and shall also be signed by the purchaser, unless such purchaser profess to be unable to write, (in which case the person making the entries hereby required shall add to the particulars to be entered in relation to such sale the words "cannot write,") and where a witness is hereby required to the sale, also by such witness, together with his place of address.

RESTRICTIONS AS TO SALE OF ARSENIC UNDER TEN POUNDS' WEIGHT.—PROVISION FOR COLORING ARSENIC.

II. No person shall sell less than ten pounds' weight of arsenic at any one time for any purpose whatsoever, or any quantity whatsoever of arsenic required or stated by the purchaser to be required for any agricultural purpose, or for any other purpose, save where such admixture as hereinafter mentioned is represented by the person purchasing the same to render such arsenic unfit for the purpose for which it is required, unless the same be first mixed with soot or indigo in the proportion of one ounce of soot or half an ounce of indigo at the least to one pound of the arsenic, and

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so in proportion for any greater or less quantity; and no person shall sell less than ten pounds' weight of arsenic at any one time to any person other than a male person of full age, or to any person who is unknown to the person selling such arsenic, or who, before the delivery of such arsenic on such sale, does not sign his name to the entries herein required on such sale, unless the sale be made in the presence of a witness who is known to the person selling the arsenic, and to whom the purchaser is known, and who signs his name, together with his place of address, to such entries before the delivery of the arsenic to the purchaser.

PENALTY FOR OFFENDING AGAINST THIS ACT.

III. If any person shall sell any arsenic, save as authorized by this Act, or on any sale of arsenic shall deliver the same without having made and signed the entries hereby required on such sale, or without having obtained such signature or signatures to such entries as required by this Act, or if any person purchasing any arsenic shall give false information to the person selling the same in relation to the particulars which such last-mentioned person is hereby authorized to inquire into of such purchaser, or if any person shall sign his name as aforesaid as a witness to a sale of arsenic to a person unknown to the person so signing as witness, every person so offending shall for every such offence, upon a summary conviction for the same before two Justices of the Peace, be liable to a penalty not exceeding twenty pounds.

ACT NOT TO PREVENT SALE OF ARSENIC IN MEDICINE UNDER A MEDICAL PRESCRIPTION.

IV. Provided that this Act shall not extend to the sale of arsenic when the same forms part of the ingredients of any medicine required to be made up or compounded according to the prescription of a legally qualified medical practitioner, or a member of the medical profession, or to the sale of arsenic by wholesale to retail dealers or others in quantities exceeding one hundred pounds in weight at one time upon orders in writing in the ordinary course of wholesale dealing.

"ARSENIC" TO INCLUDE ARSENIOUS COMPOUNDS.

V. In the construction of this Act the word "Arsenic" shall include arsenious acid and the arsenites, arsenic acid and the arseniates, and all other colorless poisonous preparations of arsenic.

THE GOLD USED BY DENTISTS.

To the Editor of THE TIMES.

SIR,—My attention was very forcibly drawn to a short paragraph in the corner of *The Times* of Monday, headed "The Gold used by Dentists," and I could but regret, for the public benefit, that a caution so valuable had not occupied a more prominent place in your widely-circulated journal.

It has happened, unfortunately, to a member of my family, that a most severe and distressing disease has originated from the very cause assigned by the writer of that article, namely, the impure metal used in the construction of artificial teeth. Unhappily for me, in my ignorance of the results, I consulted a dentist upon the strength of a flaming advertisement, rather upon the recommendation of my medical attendant; and now, while I witness the distressing results in my own family, I feel assured that your caution may be the means of preventing others from incurring the same danger.

The writer of the paragraph proposes that all the gold used in the manufacture of teeth should be stamped as standard gold—a very excellent suggestion; but I am informed that among the respectable members of the profession, the gold employed is of a standard even higher than that which is stamped, and that from this metal no evil results can possibly accrue, but that where a competition exists to manufacture teeth as men would make pen-knives, at so much per dozen, the quality of the metal is to be suspected. I will not occupy more space than to express a hope that my desire to save others from danger may be a sufficient apology for offering this for your publication.

I am, Sir,
Your obedient servant,
March 20th. A. B.

ASPHYXIA FROM CARBONIC ACID GAS.*

DR. W. T. Parker, who reports this case, states that he was called at 6 A.M. to two female servants, found asphyxiated in their sleeping room, mother and daughter. The daughter was in bed, and quite dead, though her body was still warm and flexible. The mother was found crouched down in the corner of the room most remote from the bed, and under a window, entirely unconscious, and pulseless; extremities cold,

*American Journal of the Medical Sciences.

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pupils dilated and sensible, jaws firmly locked, countenance livid, lips pale; the only sign of life being a slight impulse of the heart felt by the hand. Cold water was dashed on her face and breast immediately, and caused slight respiration. The jaws were forced open, and some rum poured into her mouth excited a cough, and power of deglutition. Large sinapisms were applied to the extremities, friction was used, and hot brandy and water with infusion of capsicum was administered. This treatment was continued with a prospect of success till 7 A.M., when the coldness seemed to increase, the respiration was less distinct, the trifling pulse which had begun to be felt was marked by subsultus, general spasms seemed to be commencing, and the abdomen, which was at first of natural size, became greatly swollen; not the least indication of consciousness had then appeared. Venesection ʒvj. The blood seemed very fluid, and respiration became more free, but symptoms of sinking made it necessary to tie up the arm. A stimulating enema was now given, causing free vomiting with easier respiration, and a thorough alvine evacuated. The sinapisms were renewed, and cold water freely poured on the head. This treatment was continued perseveringly for three hours, the least relaxation of effort causing a return of bad symptoms. At 9½ A.M. the pupils gave indications of sensibility, and the pulse could be felt. At 10 o'clock she could hear, the swelling of the abdomen was gone, and respiration was regular. At 12 o'clock she recognised persons, and during the day she gradually recovered.

The cause of this accident was carbonic acid gas, which escaped from a joint in a furnace flue, which passed through their room (a basement) to the chimney, their bed being directly under the leak, so that the gas was poured directly upon the two women, as water would have been from a spout. The daughter was found turned upon her face, which was very dark from the settling of the blood. Copious epistaxis had occurred, and the bladder had been evacuated; there was no protrusion of the tongue, but a slight contraction of the brow and post-mortem rigidity soon became strongly marked.

They went to bed at 9 P.M., and the mother remembers that, soon afterwards, her daughter complained of headache, and "a smell of gas," and that she rose and closed the door.

SUPERPHOSPHATE OF IRON.*

Dr. Routh stated, in reference to the new preparation of iron he brought before the Society on a former occasion, that it had been analyzed and found to be a new salt—a superphosphate of iron dissolved in an excess of phosphoric acid. It was quite free from any ferruginous flavour, and was indeed exceedingly pleasant to take, so that it was very well adapted for children. As he had said before, he believed it to be more speedy in its operation than many other preparations of iron. It had now been prepared in the form of a syrup by Mr. Greenish, of 20, New-street, Dorset-square, which is much cheaper than that of the iodide of zinc. He could strongly recommend it to the profession.

SWAIN'S VERMIFUGE. (AMERICAN PATENT MEDICINE.†)

Semen contra	60	grammes
Valerian	45	,,
Rhubarb	45	,,
Spigelia	45	,,
White Agaric	30	,,
Essence of tanacetum ..	2	,,
——— cloves	3	,,

Boil the first five substances with sufficient water to form 3 kilogrammes of decoction; dissolve the essence in 1 kilogramme of alcohol, add the decoction and filter it.

NEW MODE OF ADMINISTERING COD-LIVER OIL.‡

M. Loze, a naval surgeon, stated that he had attributed the failures of this remedy in phthisis to its non-absorption, and that, with the view of effecting this, he had combined the oil with a mucilage containing pancreatic juice, which thus forms an artificial chyle. In this form the oil is readily and completely absorbed, and its effect more directly obtained in phthisis.

POISONING BY HYOSCYAMUS.§

BY M. CAUDRAY, OF VAUCLUSE.

M. Caudray has recently met with four cases of poisoning by Hyoscyamus. Four monks ate the poison, which they had mistaken for some other vegetable, in a dish prepared for dinner. In two hours two of them were in a state of delirium bordering

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* *Lancet.*
† *Bulletin therapeutique.*
‡ *Medical Gazette.* § *Ibid.*

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on insanity, and a third was so violent that it required six persons to control him. The fourth having eaten less than the others was not so seriously affected. Emetics were immediately administered with the best effects. A dog which ate a portion of the food was found some time afterwards in a state of stupor.

THERAPEUTICAL PROPERTIES OF THE FRUIT OF THE CEDRON.*

BY M. LEWY.

In the warmest parts of New Grenada, in the Sierras Calientes, a tree is met with which attains to a very large size, and which is named by the natives, Cedron (Simaba Cedron). The fruit of this tree resembles in appearance the nux vomica, and, like that, is distinguished by its extreme bitterness. The natives attribute to it great virtue in the treatment of the bites of serpents, in hydrophobia, and in intermittent fevers. It is given in doses of five centigrammes (= 0·77212 Eng. gr.), in the form of a powder, mixed with brandy. In larger doses this fruit acts as a violent poison. M. Lewy has discovered that its active properties reside in a principle which he has succeeded in separating, and to which he has given the name of *cedrine*.

SUCCESSFUL EMPLOYMENT OF KOUSSO IN TWO CASES OF TÆNIA SOLIUM.†

BY JOHN THOMAS, ESQ., M.D.

The two following cases afford additional testimony to the efficacy of the brayera anthelmintica as a vermifuge in cases of tape-worm.

As the efficacy of every remedy is greatly dependent upon its freedom from adulteration, I may state that the specimen of kousso employed by me was kindly presented to me by Mr. R. Sandford, surgeon, of Baschurch, who himself procured it, during his residence in Jerusalem, from an Abyssinian merchant.

A scruple and a half of the powdered kousso was infused in four ounces of warm water, allowed to stand for half an hour, and then, having been stirred up with a spoon, the whole was swallowed at once.

A similar dose was given at eleven o'clock the same morning, to each of two young women, both of whom had a short time previously passed portions of tape-worm, and the patients were detained in the hospital for the remainder of the day, in order that the effects of the medicine might be observed, which were, nausea and sensation of thirst, followed by catharsis, and the expulsion of a quantity of tænia solium. In one case, only a few inches of the parasite came away; in the other, some eighteen or twenty feet, and in both instances the *head of the animal was evacuated*.

There had been no previous treatment by cathartics, or other medication.

I had only once previously employed this remedy, in place of the ordinary mixture of turpentine and castor-oil, and in this instance the alvine evacuations were by some mistake thrown away, so that no direct evidence of the expulsion of the parasite could be obtained; but the symptoms of which the patient complained have never recurred. The dose then given was half an ounce, but this produced violent purging. The small quantity administered in the other two instances appears to have been quite ineffectual, and also produced catharsis, as the brayera anthelmintica does when taken in its native locality, by the inhabitants of Abyssinia, who, as my friend Mr. Sandford remarks, in a note which accompanied his present of kousso, "never travel without it, and they require a large dose, as they will eat eighteen pounds of raw meat at one meal." But we learn from Johnston's *Travels in Abyssinia*, that the administration of these large quantities is not without its ill effects, for he says,—"Even men have been known after a large dose to have died the same day from its consequences—no civilized stomach could bear the bulk of the drug necessary to produce its effects."

Dr. Pereira states the dose for an adult to be half an ounce, infused for ten minutes in ten ounces of lukewarm water.

ON ACONITINA.*

BY DR. A. VON PLANTA.

Aconitina, prepared by Merck, of Darmstadt, is a yellowish-white amorphous powder. It is not quite pure, and yields by combustion a not inconsiderable portion of inorganic matter. For analysis, therefore, it requires purification. This was effected as follows:—

The aconitina was dissolved in ether, by which a brownish resinous-looking substance remained undissolved. By evaporation, by

* *Medical Gazette.*
† *Lancet.*

* Buchner's *Repertorium*, Bd. vi., Heft 3, p. 381.

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means of the air-pump, the aconitina was obtained in the solid state. The alkaloid thus purified was dissolved in absolute alcohol, and the solution poured into water with strong agitation. The aconitina was thrown down in the form of a flocculent precipitate, which was dried by means of the air-pump, and was then found to be pure white. Aconitina thus purified possesses, according to Planta, the following properties:—

It is a perfectly colorless inodorous powder, which is permanent in the air. It has a greater specific weight than water, in which it is almost insoluble. Alcohol dissolves it more readily; ether less so. At 80° C. it melts into a transparent vitreous substance without losing in weight. If heated beyond 120° C. it becomes brownish, and is decomposed without evaporating. It has a strong alkaline reaction, and forms with acids neutral compounds, which appear to possess no tendency to crystallize. Ammonia and potassa throw it down from its solutions in flocculi, which are but slightly soluble in an excess of the precipitant. Carbonate of ammonia, bicarbonate of soda, and phosphate of soda, occasion no precipitate. Chloride of gold causes a solid yellowish-white precipitate, scarcely soluble in muriatic acid. Chloride of platinum has no effect. Chloride of mercury, and also sulphocyanide of potassium, produce white caseous precipitates; that produced by the first reagent dissolves tolerably readily in muriatic acid and in sal ammoniac. Tincture of iodine causes a kermes-brown precipitate. Tannic acid or tincture of galls produces, upon the addition of one drop of muriatic acid, solid flocculi, which are only dissolved in a large quantity of muriatic acid. Nitro-picric acid causes a solid precipitate of a sulphur-yellow colour, and which is insoluble in ammonia.

Repeated analyses both of the pure aconitina and of its compounds, with chloride of gold, showed its composition to be as follows:—

	Per Centage.	Eq.
Carbon	67·54	60
Hydrogen	8·81	47
Nitrogen	2·62	1
Oxygen	21·01	14
	100·00	

THERAPEUTICAL PROPERTIES OF SULPHATE OF CADMIUM.*

M. GRIMAND read an essay, in which he stated that, over and above its emetic properties, the sulphate of cadmium possesses specific anti-syphilitic properties at least as efficient as those of corrosive sublimate. In rheumatism also, and gout, M. Grimand claimed for this remedy the utmost efficacy, as also for a host of other internal and external maladies. He regarded it as equal to tartrate of antimony in pneumonia, and capable, when applied externally as an ointment, of producing pustules of the same character. Lastly, it was said to possess antiseptic properties, and to be suited for preserving flesh or for embalming.

* *Medical Gazette.*

THE PHARMACOPŒIA OF THE ROYAL COLLEGE OF PHYSICIANS OF LONDON FOR 1851. Translated by a Physician. London: H. Renshaw.

The author has done considerable service in presenting to those who require it a very correct translation of the Pharmacopœia of a size which admits of its being carried in the pocket. This is a convenient work, in the fullest sense of the word.

TO CORRESPONDENTS.

"A.J.S.C." Shall hear from us in a day or two.

"C. P." is requested to send us his name and address, that we may write to him.

Answered by Post:—"D. H. W. H.;" "M.P.S.;" "Chemicus;" "A Student;" "An Apprentice;" "A Calico Printer;" "Medicus;" "J. F.;" "A. B.;" "Delta."

Received, the *The Liverpool Albion*, for April 21. We shall feel obliged to our correspondent who kindly forwarded this paper, if he will do us the favor to inform us what was his motive for marking the passages in question.

"INTRODUCTION TO THE STUDY OF CHEMISTRY." The second of this series of articles is unavoidably postponed until next month.

We have received from Mr. H. A. Morton, of Francis Street, a catalogue of the articles supplied by him, for the use of Chemists, Druggists, Surgeons, &c.—The prices are very moderate.

NOTICE.—*All Communications, Books for Review and Substance for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No. will in future be received as late as the 24th.*

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

INTRODUCTION TO THE STUDY OF CHEMISTRY.

NO. II.

CHEMICAL NOMENCLATURE AND SYMBOLS.

We now proceed to give an outline of the system of nomenclature at present in use amongst chemists, and will do so as briefly as is consistent with imparting sufficient knowledge of the subject, premising that the student will become more fully acquainted with this important branch of chemistry as he progresses further in the study of the science. Avoiding, as far as practicable, reference to the considerations on which this nomenclature is based, and which would be almost unintelligible to the beginner, we will endeavor to impart to him sufficient to facilitate the comprehension of our succeeding instructions.

The great object of any system of nomenclature should be to apply to the bodies named such denominations as will give the best idea of their nature. In the science of chemistry this has been done to a considerable extent; so that a well informed chemist, from the name of a compound learns in some measure its composition, so far at least, as its proximate constituents are concerned. For example, the name of the salt, *sulphate of lime*, informs us that it is a compound of sulphuric acid and lime.

The simple bodies of chemistry may be divided into non-metallic bodies and metals. The non-metallic bodies are :—

Oxygen	Bromine	Nitrogen	Phosphorus
Chlorine	Fluorine	Sulphur	Carbon
Iodine	Hydrogen	Selenium	Boron.

The combination of five of these with the remaining seven, with each other, and with the metals, are designated by names having the termination *ide*, and those of the remaining seven by names having the termination *uret*. Thus we have ox*ides*, chlor*ides*, iod*ides*, &c., and hydrog*urets*, phosph*urets*, carb*urets*, &c., &c. However, when these combinations are of acid nature, another rule is observed, and the acids are named from the substance acidified, the names ending in *ous* or *ic*, as they contain less or more of the acidifying constituent. When a substance forms with oxygen, for instance, only one acid compound, the termination *ic* is employed; when it forms two, the termination *ic* is applied to the acid which contains most oxygen, the termination *ous* being reserved for that which contains least; when there are more than two, a different form has to be employed, as may be shewn by taking the four principal acids of sulphur as an example, viz., hyposulphurous acid, sulphurous acid, hyposulphuric acid, and sulphuric acid. Those acids which contain the largest quantity of oxygen are also sometimes designated by the prefixes *per*, *hyper*, or *oxy*, for instance, per or oxy chloric acid, hyper or per manganic acid. The proportions of oxygen, chlorine, iodine, &c., in a non-acid compound are shewn by the use of the prefixes derived from the Greek and Latin numerals, as, protoxide for the first degree of oxidation, deutoxide or binoxide for the second, teroxide or tritoxide for the third, and *peroxide* for the highest degree of oxidation.

The salts formed with acids ending in *ous* and *ic* have the terminations respectively of *ite* and *ate*; thus sulphur*ous* acid forms sulph*ites* in uniting with bases, and sulphur*ic* acid, sulph*ates*. When the acid combines with the base in two or more proportions, the quantity of the acid in the salt is designated by the use of the prefixes

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proto, bi, deuto, ter, per, &c., as in the cases of the oxides, chlorides, &c. Thus, we have proto and bicarbonate of potassa, &c. When the base combines with the acid in the proportion of two atoms to one of acid, the prefix di is employed, as in the case of dinitrate of lead.

An *acid* is a compound consisting of two or more simple bodies combined in various proportions, and possesses the property of combining with a *base*. A base is any substance capable of combining with an acid to form a *salt*.

We have now fulfilled our intention of giving an outline of chemical nomenclature sufficient for the present guidance of the reader, reserving further instruction until we come to speak of each element individually and in detail, and shall now pass to the consideration of a branch of the science intimately connected with it, namely Chemical symbols.

In order to present to the mind in a brief and concise manner, the names of elements, and the compounds which they form, and likewise to show at a glance the action by which their formation is effected, chemists are in the habit of employing certain symbols, the nature and use of which we shall now explain so far as is at present necessary. And here we must beg those of our readers who may take up these pages as their first lessons in our beautiful science not to be disheartened by the apparent dryness of these our first instructions. A careful and attentive study of them will render their future task much lighter; and when we come to the description of chemical operations, and to the detail of all the facts of the science, explaining the laws on which they are based, and the theories adopted to account for them, they will reap a rich reward of valuable knowledge. Moreover, as the limited space of a periodical the chief business of which is the publication of new facts and discoveries, precludes us from going so deeply into the subject as do the excellent elementary works of Professor Brande, Dr. Turner, (Gregory and Liebig's edition), Sir Robert Kane, Professor Graham, &c., we earnestly recommend those who would become masters of the science, after studying all our articles, to improve their chemical education by the study of one or other of those admirable treatises, an occasional reference to which, even during our course of instruction they will find of considerable value.

Symbols consist of the initial letter of each element, and when several have the same initial, another letter, or more, of the name is added.

We subjoin a list of the elements with the symbols by which they are most commonly denoted: *

1 Aluminum Al	23 Hydrogen H	(Kalium) K
2 Antimony (Stibium) St.	24 Iodine I	44 Rhodium R
3 Aridium Ard	25 Iridium Ir	45 Ruthenum Ru
4 Arsenic As	26 Iron (Ferrum) Fe	46 Selenium Se
5 Barium Ba.	27 Lanthanium La	47 Silicon Si‡
6 Bismuth Bi	28 Lead (Plumbum) Pb	48 Silver (Argentum) Ag
7 Boron B	29 Lithium Li	49 Sodium So
8 Bromine Br	30 Magnesium Mg	or
9 Cadmium Cd.	31 Manganese Mn [Hg	Natrium Na
10 Calcium Ca	32 Mercury (Hydrargyum)	50 Strontium Sr
11 Carbon C	33 Molybdenum Mo	51 Sulphur S
12 Cerium Ce	34 Nickel Ni	52 Tellurium Te
13 Chlorine Cl	35 Niobium Nb	53 Terbium Tb
14 Chromium Cr	36 Nitrogen N †	54 Thorium Th
15 Cobalt Co	37 Osmium Os	55 Tin (Stannum) Sn
16 Columbium(Tantalum)Ta	38 Oxygen O	56 Titanium Ti
17 Copper (Cuprum) Cu	39 Palladium Pd	57 Tungsten ¶ (Wolfram) W
18 Didymium D	40 Pelopium Pe	58 Vanadium Va
19 Erbium E	41 Phosphorus Ph	59 Uranium U
20 Fluorine F	42 Platinum Pl	60 Yttrium Y
21 Glucinum G	43 Potassium P	61 Zinc Zn
22 Gold (Aurum) Au	or	62 Zirconium Zr

* In some cases, the symbol is derived from the Latin name, as Antimony (Stibium) St.

† Also called Azote (Az.) This name and this symbol are chiefly employed by continental chemists.

‡ Sometimes called *Silicium*.

¶ The German name.

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...is used to sepa-
...compound. Thus
...valent of hydrogen
...e resulting compound
...frequently written Aq
...atin word for water). The
... H,O may also be used for
...etter q. is also occasionally
...e symbol of water.
...mple of the formula of a com-
... give the following:—
...O, CO^2+ 10 Aq.
...represents the crystallised carbonate
...a, which is sometimes (but less cor-
...ly) called subcarbonate of soda. The
...ove formula shows its composition to be,

	Equiv.		
Sodium	1 Na	=1 Soda	=Carbonate of soda + 10 equivs water of crystallisation.
Oxygen	1 O		
Carbon	1 C	=1 Carbonic acid.	
Oxygen	2 O_2		
Water	10·10 Aq.		

But carbonic acid combines with soda in two proportions.* The bicarbonate of soda has the formula.

$$NaO,2\ CO^2+Aq.$$

representing 1 equivalent of bicarbonate of soda. This formula shows the composition of the salt to be,

	Equiv.	
Sodium	1	= 1 Soda
Oxygen	1	
Carbon	2	
Oxygen	4	= 2 Carbonic acid
Water	1	

These examples will be sufficient to show the mode of symbolic notation for com-...ound bodies. The comma, as will be per-... is used to separate the acid from ...nd the sign + is made to affect ...onstituent (water) which has least ...or the salt properly so called, and ...es with it only to produce the par-...ar form of carbonate of soda, and which ...called water of crystallisation, not of ...omposition. This water can be driven off by heat, without destroying or decomposing the salt.

In writing formulæ, it is the common practice to place the basic or electro-positive element before the electro negative. We write oxide of lead b O and sulphate of lead b O, SO^3.

Several authors have endeavoured to introduce great variations in the system of symbolical notation; but that of which we have given this brief outline is the one in most common use; we shall adopt it throughout these articles. But, in order that our readers may be enabled to understand the symbols of other systems we will give some of the principal varieties.

In one system, the atoms of oxygen are shown by a number of dots placed over the atom; thus nitric acid NO^5 is written, $\overset{\cdot\cdot\cdot\cdot\cdot}{N}$. Berzelius designated the compounds of sulphur by commas; thus he writes $\overset{,}{H}$ for sulphuretted hydrogen; he represents two equivalents of an element by a line through or under its symbol thus $\overline{H}$ or $\underline{H}$ stands for 2 atoms of hydrogen. He abbreviates the organic acids by using a symbol consisting of their initial letters with a line over them. Thus $\overline{T}$ $\overline{C}$ and $\overline{F}$ represent respectively tartaric, citric, and formic acids.

Some compounds which behave like simple bodies or bases are likewise sometimes indicated in a special manner; thus, cyanogen, which is composed of two equivalents of carbon and one of nitrogen, instead of being written C^2N, is sometimes written Cy; ethule, instead of C^4H^5, is indicated by the symbol E or Et. Professor Brande has represented the acids by an acute accent on the right hand side of the initial letter of their basic elements. Thus, N′, S′, P′, C′, HCl′, denote respectively nitric, sulphuric, phosphoric, Carbonic and hydrochloric acids. The letters M, B and R, are occasionally used in a general sense for metal, base and radical, that is to say, for example, in stating in general terms the proportion of either of these in a compound.

[Note. Should any of our readers find some further explanations on any point

* There is a sesquicarbonate of soda, which occurs native on the banks of some lakes in Mexico and Africa. But it cannot be produced by artificial means.

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means of the air-pump, the aconitina was obtained in the solid state. The alkaloid thus purified was dissolved in absolute alcohol, and the solution poured into water with strong agitation. The aconitina was thrown down in the form of a flocculent precipitate, which was dried by means of the air-pump, and was then found to be pure white. Aconitina thus purified possesses, according to Planta, the following properties :—

It is a perfectly colorless inodorous powder, which is permanent in the air. It has a greater specific weight than water, in which it is almost insoluble. Alcohol dissolves it more readily; ether less so. At 80° C. it melts into a transparent vitreous substance without losing in weight. If heated beyond 120° C. it becomes brownish, and is decomposed without evaporating. It has a strong alkaline reaction, and forms with acids neutral compounds, which appear to possess no tendency to crystallize. Ammonia and potassa throw it down from its solutions in flocculi, which are slightly soluble in an excess of the precipitant. Carbonate of ammonia, carbonate of soda, and phosphate of soda cause no precipitate. Chloride of gold produces a yellowish-white precipitate, soluble in muriatic acid. Chloride of platinum has no effect. Chloride of mercury and sulphocyanide of potassium cause caseous precipitates. Tincture of galls is the first reagent dissolved by dilute muriatic acid and by the mixture of iodine and iodide of potassium. Tannin produces, upon the addition of muriatic acid, a precipitate dissolved by an excess of the acid. Nitrate of silver causes a precipitate which is insoluble in nitric acid, but soluble in ammonia.

parties, the sulphate of ca… specific anti-syphilitic … as efficient as those of … In rheumatism also, … claimed for this re… as also for a host … ternal maladies … to tartrate of … capable, w… ointment, … charact… antise… pres…

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…ssed com-

			(Kalium) K
			44 Rhodium R
			45 Ruthenum Ru
			46 Selenium Se
			47 Silicon Si‡
		28 Lead (Plumbum) Pb	48 Silver (Argentum) Ag
		29 Lithium Li	49 Sodium So
		30 Magnesium Mg	or
		31 Manganese Mn [Hg	Natrium Na
		32 Mercury (Hydrargyum)	50 Strontium Sr
		33 Molybdenum Mo	51 Sulphur S
		34 Nickel Ni	52 Tellurium Te
		35 Niobium Nb	53 Terbium Tb
		36 Nitrogen N†	54 Thorium Th
		37 Osmium Os	55 Tin (Stannum) Sn
		38 Oxygen O	56 Titanium Ti
		39 Palladium Pd	57 Tungsten ¶ (Wolfram) W
		40 Pelopium Pe	58 Vanadium Va
		41 Phosphorus Ph	59 Uranium U
		42 Platinum Pl	60 Yttrium Y
		43 Potassium P	61 Zinc Zn
		or	62 Zirconium Zr

* In some cases, the symbol is derived from the Latin name, as Antimony (Stibium) St.

† Also called Azote (Az.) This name and this symbol are chiefly employed by continental chemists.

‡ Sometimes called *Silicium*.

¶ The German name.

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Symbols are likewise employed, for indicating the proportions of the elements in compound bodies; when only 1 atom of an element is to be designated, the symbol is used without any numeral being prefixed or affixed: for example, NO represents 1 equiv. of nitrogen, or 14 parts by weight, and 1 equivalent of oxygen, or 8 parts by weight. NO^5 represents 1 equivalent of nitrogen, and 5 equivs. of oxygen. The figure affixed, which may be placed either above, below, or on a level with the symbol, denotes the proportion of the element symbolized in the compound. Several equivalents of an element are occasionally denoted by figures prefixed.

When several symbols are used in showing the constitution of a compound, or in exhibiting a chemical action, the collection of symbols is called a formula. The sign of addition, +, or a comma is used to separate the elements of a compound. Thus H+O signifies 1 equivalent of hydrogen and one of oxygen: the resulting compound is water which is frequently written Aq (from aqua, the Latin word for water). The formula HO and H,O may also be used for water. The letter q. is also occasionally adopted as the symbol of water.

As an example of the formula of a compound, we give the following:—

$NaO, CO^2 + 10$ Aq.

which represents the crystallised carbonate of soda, which is sometimes (but less correctly) called subcarbonate of soda. The above formula shows its composition to be,

	Equiv.		
Sodium 1 Na Oxygen 1 O	=1 Soda	= Carbonate of soda + 10 equivs water of crystallisation.	
Carbon 1 C Oxygen 2 O_2	=1 Carbonic acid.		
Water 10·10 Aq.			

But carbonic acid combines with soda in two proportions.* The bicarbonate of soda has the formula.

$NaO, 2\,CO^2 + Aq.$

representing 1 equivalent of bicarbonate of soda. This formula shows the composition of the salt to be,

	Equiv.	
Sodium	1	= 1 Soda
Oxygen	1	
Carbon	2	= 2 Carbonic acid
Oxygen	4	
Water	1	

These examples will be sufficient to show the mode of symbolic notation for compound bodies. The comma, as will be perceived, is used to separate the acid from the base, and the sign + is made to affect only the constituent (water) which has least affinity for the salt properly so called, and combines with it only to produce the particular form of carbonate of soda, and which is called water of crystallisation, not of composition. This water can be driven off by heat, without destroying or decomposing the salt.

In writing formulæ, it is the common practice to place the basic or electro-positive element before the electro negative. We write oxide of lead b O and sulphate of lead b O, SO^3.

Several authors have endeavoured to introduce great variations in the system of symbolical notation; but that of which we have given this brief outline is the one in most common use; we shall adopt it throughout these articles. But, in order that our readers may be enabled to understand the symbols of other systems we will give some of the principal varieties.

In one system, the atoms of oxygen are shown by a number of dots placed over the atom; thus nitric acid NO^5 is written, $\dot{\dot{N}}$. Berzelius designated the compounds of sulphur by commas; thus he writes $\dot{H}$ for sulphuretted hydrogen; he represents two equivalents of an element by a line through or under its symbol thus $\bar{H}$ or $\underline{H}$ stands for 2 atoms of hydrogen. He abbreviates the organic acids by using a symbol consisting of their initial letters with a line over them. Thus $\bar{T}$ $\bar{C}$ and $\bar{F}$ represent respectively tartaric, citric, and formic acids.

Some compounds which behave like simple bodies or bases are likewise sometimes indicated in a special manner; thus, cyanogen, which is composed of two equivalents of carbon and one of nitrogen, instead of being written C^2N, is sometimes written Cy; ethule, instead of C^4H^5, is indicated by the symbol E or Et. Professor Brande has represented the acids by an acute accent on the right hand side of the initial letter of their basic elements. Thus, N′, S′, P′, C′, HCl′, denote respectively nitric, sulphuric, phosphoric, Carbonic and hydrochloric acids. The letters M, B and R, are occasionally used in a general sense for metal, base and radical, that is to say, for example, in stating in general terms the proportion of either of these in a compound.

[Note. Should any of our readers find some further explanations on any point

* There is a sesquicarbonate of soda, which occurs native on the banks of some lakes in Mexico and Africa. But it cannot be produced by artificial means.

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necessary, or desire information on any matter not touched on, we shall be most happy to answer questions, either in THE CHEMIST or by letter, as may suit our own convenience or the requirements of the case. We beg, therefore, that we may be applied to without hesitation.]

ON THE CONNEXION OF CHEMICAL FORCES WITH THE POLARISATION OF LIGHT.*

BY NEVIL STORY MASKELYNE, ESQ., M.A.

No facts which can throw light upon the ultimate molecular structure and condition of chemical compounds can fail of possessing interest of a high character, as well for those whose thoughts only casually dwell upon questions of physical science, as for the mathematician and the chemist. To the mathematician, indeed, they would, if clearly unfolded, supply the data for him to undertake the resolution of the questions of chemical combination and chemical change, by treating them as problems involving the action of mechanical laws. To the chemist, the acquisition of such knowledge would be the removal of some of the profoundest difficulties of his philosophy; but this is to be sought only in the most difficult paths of the whole range of science. The question of the connexion of chemical type with crystalline form, the fruitful cause of so much contention among mineralogists as to the questions of mineral species, is one concerning which we have no complete and certain knowledge; for the facts of dimorphism show, that implicated with this question are the actions of other forces, such as electric condition, and above all the mysterious molecular alterations induced by heat. Another direction in which such inquiries have been pursued, has been in tracing the phænomena resulting from the property possessed by many bodies, of modifying a plane-polarised ray of light, by what is termed circular-polarisation. This property, from its being proved to be, in a large number of cases, an expression of the *molecular* structure of the substance, and as such inseparable in many cases from its chemical existence, may be taken, whenever this can be shown to be the case, as an evidence of its individuality, and may be used to determine the question of the permanency or transitory character of the molecular type of the substance. The information thus gained may be but vaguely defined, and the truth but darkly seen, yet does it nevertheless afford a valuable and interesting point of view for studying the molecular nature of bodies.

M. Biot has, during the last forty years, enriched chemico-physical science by a series of memoirs detailing the results of his study of these phænomena. He has shown the value of this means of tracing changes in chemico-molecular constitution.

M. Pasteur has carried forward this inquiry into a new channel by tracing a connexion between this property in substances, of circularly polarising light, and their crystalline character.

But as it would be impossible to explain the nature of his investigations, or their results, without a preliminary knowledge of the meaning of the terms "circular polarisation" and hemihedrism," it was necessary first to enter a little upon the explanation of them.

Accordingly a ray was explained as being a direction of light, having no relations to space which differed from each other in directions perpendicular to its length. Thus without complicating the subject, by using the language of the beautiful wave-theory, a ray might be imagined as a cylinder of minutest diameter, but indefinite length. When such a ray is reflected at a certain angle from glass, or such like substance, it is split into two; one going into, and through the glass if it be not opake, the other being reflected from it. These two rays no longer possess the same "absence of sides" as the original ray. For the one has been as it were flattened down to "a strip," while the other has also been flattened similarly into a "strip," but the latter strip is at right angles in regard to its "flattened plane" to what the other is. A similar bifurcation of the ray is produced in the interior of what are called doubly refracting crystals. This bifurcation and flattening of the ray is termed "plane polarisation" of it; and it is so far a true instance of polarity, as that the two rays have equal and similar properties in opposed directions.

This was exhibited by the Lime Light. The double image of a small round hole formed by a crystal of Iceland spar was thrown on a screen, and each beam shown to be most capable of reflexion in a plane in which the other was incapable of being reflected at all. The action of the tourmaline as a doubly refracting crystal which absorbs one of the rays was then explained; and it was shown that the position of the tourmaline in which it intercepted one ray entirely, was exactly the position in which

* Royal Institution, 28th March, 1851.

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it gave the other ray free passage. The optic axis of a crystal was then defined to be a direction in it along which the light could pass through the crystal without undergoing any change whatever. The central ray of a polarised beam of light, traversing a piece of calc-spar along its optic axis, was shown to be intercepted or transmitted by a tourmaline, precisely as if the section of the crystal of calc-spar were away.

An exception was however stated to exist to this law of the neutrality of the optic axis. When a section of quartz, cut so that the beam could career along its optic axis, was put in the path of the polarised ray, it was found that instead of permitting the ray to be eclipsed by the tourmaline when this was placed in the position to eclipse it, that ray on the contrary fell on the screen endowed with beautiful color; and furthermore that the revolution of the tourmaline induced the most brilliant succession of colors, in the order, in the instance exhibited, of red, plum-color, blue, green, orange, red. It was shown, however, that another specimen exhibited these colors in the reverse order of red, orange, green, blue, plum-color, red; in which order the former specimen of quartz produced these colors when the tourmaline was turned in the *opposite* direction. Hence these are termed right-handed and left-handed polarisations. The whole of these phœnomena were attributed to a complicated set of movements of the light within the crystal, the *resultant* of which was practically a rotation of the plane in which the ray was capable of being reflected, so that the thicker the crystal, the further round the tourmaline had to be turned to permit the ray to pass it, or to be eclipsed, as the case might be. The opposite order of the colors was explained by the fiction of supposing the one to be the effect of a left-handed thread to the screw and the other of a right-handed thread characterising the spiral in which the plane of polarisation was supposed to rotate. Of course this was only a popular way of explaining the phœnomenon, it being really due to a more complicated series of movements, which were explained by Fresnel in the most triumphant manner by the wave-theory.

The color was accounted for by the idea of the red following a longer spiral (having a coarser thread to the screw) than that of the orange, this than the yellow, and so on up to the violet. Without the tourmaline in front all would emerge and form white light; but the tourmaline only allows such rays to pass it as are capable of passing it in its particular position; *i. e.* only such, the rotation of whose plane has brought them round to the position of the plane in which the tourmaline lets the light through.

The singular fact of amethyst being a combination of alternate layers of right- and left-handed quartz was then exhibited, both by throwing the image of the alternate layers on the screen, and afterwards by showing that the general effect of a traversing polarising beam was to produce a neutrality of action. Other substances, however, produce phœnomena of circular polarisation. Uncrystallised, fused tartaric acid, and barley-sugar, &c. produce them; and these bodies when dissolved, and many more in the form of liquids also, do so, some of which were exhibited. But the silica of which quartz consists entirely loses this property when divested of its crystalline character, whether artificially or in its natural state as chalcepeny, opal, &c. All other bodies retain it so long as their chemical molecule retains its individuality of character.

The next point to be made clear, was the meaning of that form of crystallographic development called "hemihedrism." Haüy's great law was, that similar edges or angles were always similarly modified. The nature of similarity in edges or angles was then pointed out, and the general idea of many crystallographers of a sort of nucleus or primitive form existing on which the crystal was formed, was explained, as also the nature of the development of such a crystal by the modifications placed on the edges and angles according to the law before mentioned. But the exception to that law was not less remarkable for its generality of character than the law itself. This exception consists in the fact that very often crystals are found in which not every similar edge or angle was modified, but where every *alternate* similar edge or *alternate* similar angle was so. This circumstance was then illustrated by the actual truncation of some models; and it was shown that such alternately developed or *hemihedral* crystals may be *right* and *left*, the upper terminal modification being to the right in the one case, and the corresponding and similar lower terminal modification being then to the left, while in the other case they are exactly the converse. Hence, one crystal is, as Pasteur describes it, "*non-superposable*" to the other, the one is as the image of the other reflected in a mirror, as the right hand is compared to the left.

A beautiful connexion was then pointed out, as established long ago by the acute observation of Sir J. Herschel, that the

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plagihedral facettes of quartz indicated, by their relative positions on the crystal, the direction in which the crystal would rotate the plane of polarisation. The crystallographic character of these facettes was then pointed out, and their connexion shown with this hemihedrism. But the most beautiful instance of the connexion of hemihedrism in crystals with the direction of the rotatory power of the substance of which they are composed is afforded by the recent discoveries of Pasteur, which may now be almost traced to a law, enunciated thus: that where a substance is hemihedric when crystallised, and possesses the rotating character, the direction of the rotation is indicated by the nature of the hemihedrism.

Paratartaric acid was then introduced. It was described as extremely like tartaric acid in its chemical reactions and identical with it in composition. It was similarly formed to the latter, and was found only one year in the cream of tartar of the wine of the Vosges. Pasteur separated the crystals of the paratartrate of soda and ammonia into two several sets: the one set he showed to be hemihedric to the right, the other set to the left. The former proved to be the salt of an acid rotating to the right, the latter of one rotating to the left. On examining these acids they were found in every single property, but this rotation, identical with one another and with tartaric acid. Yet when mixed they formed again the paratartaric acid, which, like the amethyst, is without any action of a rotatory character, and the difference of which from the other two acids was then exhibited by the precipitation by the latter of a salt of lime which did not render either of the former turbid.

The author then detailed the experiments of M. Pasteur on malic and aspartic acids and asparagine, and showed how all of these could be understood to contain chemically a molecular unit common to all these and perhaps to tartaric acid, and only modified a little by the superposition as it were of other substances, in combination with it, upon the extremities of its molecule.

He also dwelt on the possibility of the paratartaric acid being a quadribasic as the tartaric acid is a bibasic acid; it being on this view a conjugate acid consisting of the two united tartaric acids. He then invited attention to the interesting nature of M. Biot's investigation of the action of tartaric acid in solution in water, and he showed that here the acid must be supposed capable of combining with an indefinite or indeed an infinite amount of water, while in other cases again, bodies (such as sugar for instance) exercise no effect upon the water and do not seem to *combine* with, but only to be dissolved in it. The former is an instance of a *continuous* and not *intermittent* sort of combination; and though we need not anticipate a recurrence of the controversy of Berthollot and Proust, yet this shows us that the actions of quantity or mass so dwelt on by the former, are not without a great significance; and that the power that can thus enable us to determine such important points in chemical statistics is well worthy of the attention of the philosophic mind.

ON THE ACTION OF CHLORIDE OF CYANOGEN ON PYROXYLIC SPIRIT.*

BY SENOR ECHEVARRIA, OF MADRID.

When a current of chloride of cyanogen is passed into pyroxylic spirit to which a little water has been added, no reaction takes place until the liquid is saturated. But when the point of saturation is arrived at, a very vivid action suddenly occurs, the liquid enters into ebullition, becomes turbid, and gives rise to a deposit of hydrochlorate of ammonia.

After having separated this salt by filtration, I distilled the filtered liquid to separate the greater part of the pyroxylic spirit and other volatile products. During this distillation, a further quantity of hydrochlorate of ammonia is deposited, and is separated by filtration and pressure; the distillation of the expressed liquid, whose boiling point rises more and more, is afterwards finished. When it has reached 284° F., the receiver is changed, and the distillation is continued until the temperature of the thick and black liquid remaining in the retort amounts to 356° or 374° F.

Beyond this point, the liquid which passes over is highly colored.

The next day, the liquid collected in the receiver, deposits a considerable quantity of perfectly transparent crystals, which may be obtained perfectly pure by pressure between folds of blotting paper.

These crystals are urethylane, which body was first obtained by M. Dumas, in the reaction of ammonia on methylo-chloroxy-carbonic ether. The crystals of urethylane are rhomboidal tables; they are deliquescent; they fuse at from 125° to 131° F., and solidify at 125° F. when they are perfectly dry; the slightest trace of

* *Comptes Rendus*, No. 16, April 21, 1851.

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moisture reduces the solidifying point to 122° F. The fused liquid enters into ebullition and volatilises without decomposition, at the temperature of 350° F. The vapor-density of urethylane is 2·62, which corresponds to 4 volumes.

Urethylane is very soluble in water; it dissolves less easily in alcohol and still less in ether.

One hundred parts of water dissolve, at 52° F., 217 parts of urethylane, whilst 100 parts of alcohol, at 59° F., dissolve only 73 parts.

Sulphuric acid diluted with its own weight of water, decomposes urethylane, when the mixture is heated, into carbonic acid, pyroxylic spirit and sulphate of ammonia, as shown by the following formula:—

$$\underbrace{C^4H^5NO^4}_{\text{Urethylane.}} + S\,O^4 + H^2O^2 = \underbrace{NH^3SHO^4}_{\text{Sulphate of ammonia}} +$$

$$\underbrace{C^2H^4O^2}_{\text{Pyroxilic spirit.}} + C^2O^4$$

When the sulphuric acid is more concentrated, it reacts on the pyroxylic spirit formed; the liquid turns black and disengages sulphurous acid and inflammable gases.

Potassa decomposes urethylane into pyroxylic spirit, ammonia, and carbonic acid, which combines with the alkali.

ON THE DIFFERENT CHEMICAL CONDITIONS OF THE WATER AT THE SURFACE OF THE OCEAN AND AT THE BOTTOM, ON SOUNDINGS.*

BY AUG. A. HAYES, ASSAYER TO THE STATE OF MASSACHUSETTS.

In comparing the surface occupied by the ocean with any large extent of land surface, we might be led to expect a want of uniformity in the distribution of saline matter throughout its mass. Those parts reposing in immediate contact with saline deposits and many decomposing rocks, would every instant receive more soluble matters than contiguous portions; and while matter to be dissolved remained, the balance of distribution would be disturbed. Local differences are known to exist, and are referred to the influence of evaporation, and to lower and upper currents, with great degree of probability. Still the belief that the water of the ocean has existed during the lapse of great geological periods of time, with the same or even a large proportion of saline matter, must gradually give way as facts connected with the decomposition of rocks are attentively studied.

The phænomena which form the subject of this communication are only remotely connected with this point of unequal distribution, being related to *kind* rather than quantity of saline parts.

The mass of ocean, exposed on its surface to the mixture of gases forming our atmosphere, absorbs both constituents, the oxygen in the larger proportion. Winds greatly favor this effect, and the increased quantity found in the water after storms is referred to this action.

When ocean water, taken at the same moment from the surface and only 100 to 200 feet under this surface, is subjected to the usual course of analysis, a larger proportion of oxygen is constantly found in the surface samples. Trials made at points from the temperate to and within the torrid zone corresponded, and only slight deviations were found in the moving waters of the gulf stream. Another kind of evidence of this fact is afforded by the observations made on the corrosion of the copper sheathing of vessels. Slight inequalities in the kinds of copper used exist; but when a large number of cases are included and the time of observation is considerable, this influence is hardly seen. It is a general law that copper sheathing corrodes most rapidly at those parts of the covered surface where by agitation the most air is dissolved in the water passing in contact with it. The fact is well known, that sea water deprived of air has no action on copper even after many years' exposure; and this relation becomes changed when we allow the same water to dissolve air. Some persons who have noticed this uniformity of corrosion at the points where the water contains the most dissolved air, have attempted an explanation on mechanical principles. They have assumed that greater friction between the moving surface and the water takes place at those points. It is not uncommon for vessels to make long voyages and return with the *chalked numbers of the sheets legible*, and active corrosion *seldom* takes place on those parts of the coppered surface really exposed to the greatest friction.

If we assume that the oxygen of the sea-water is almost wholly derived from solution of one part of the atmosphere, then the surface under existing conditions should contain the largest amount. The organised beings of the ocean, consuming the oxygen

* Silliman's *Journal*, March, 1851.

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as diffused, would constantly diminish the quantity below, and allow an inequality to exist.

The reactions taking place in the corrosion of copper by the surface-water of the ocean, considered in all their particulars, become quite complex. Without entering minutely into these, it is sufficient to adopt the usual expression, that the oxidation and corrosion of copper take place in consequence of the decomposition of hydrochlorates under the presence of oxygen and metal, a very common change, resulting in the production of oxides and chlorides.

While pursuing the subject of copper corrosion at the surface, I was some years since led to examine samples of copper which had remained some time at the bottom of the ocean. In these cases an opposite kind of action was at once recognised; and the observations have been so far multiplied, that I think a constancy of result will be observed in all cases on soundings.

Copper and bronze, and even a brass compound, were found thickly incrusted with a sulphuret of copper, formed often in crystallised layers, having a constant chemical composition, entirely free from chlorine or oxygen, the corroding agents of the surface. Specimens of copper and bronze from mud and clay at different depths, and, in one instance, from clean sand below a powerful rapid, have given thick layers of sulphurets of copper, or copper and tin.

These observations have been lately extended, and as they include other materials, I shall state them more particularly.

The Spanish vessel San Pedro de Alcantaro was blown up off the coast of Cumada, in the year 1815, and a large amount of specie dispersed and sunk. A great part of the silver dollars has been recovered during the past year, by our enterprising countrymen, from a depth between 50 and 80 feet. The coin reposed in mud, and was sometimes covered with a stratum of coral from 6 to 12 inches thick.

Two pieces, of the coinage of 1810 and 1812, were taken for analysis. The weight of such dollars, slightly worn, was 412 grs. nearly. When the coin of 1810 had lost its covering, it weighed 330 grs., or 82 grs. of the substance of the dollar had assumed the state of a sulphuret. The other weighed 356·82, or less by 55·18 grs. By exposure during thirty-five years in one case, 100 parts of the coin had been destroyed to the extent of nearly 20 parts, the other 13·39, giving an average of 16·52.

These incrustations were crystallised distinctly, and their composition was carefully determined. Water abstracted traces of chlorides of sodium and magnesia with sulphate of lime only. Acetic acid took up a compound of chlorine, carbonate of lime and oxide of copper in minute quantity. The investing coating was removed from one coin by making it the negative pole of a single galvanic circle in dilute sulphuric acid, so as to obtain the covering in sheets, a loss of sulphur taking place. Water acidulated with nitric acid, after several days, detached the covering from the other; and this sample was used for determining the sulphur, in the form of sulphuric acid, as well as the bases. Operating in this way, it was found that very small portions of chloride of sodium, magnesium and sulphate and carbonate of lime adhered to the incrustation, while the pure portion of this consisted of bisulphuret of copper with sulphuret of silver and gold; even the minute trace of the latter metal in the silver being mineralised by sulphur.

Connected with this observation is another I have made on the corrosion of an alloy of 1 silver in 500 copper, used as sheathing, in which both metals united to chlorine and oxygen, and were removed rapidly and largely by surface-water, as a simple metal would have been.

No opportunity has yet offered for continuing these examinations on copper and other metals obtained from great depths of water; and in calling the attention of chemists to this action, I hope to obtain results from those who are more favorably situated for observation.

The opposite tendencies of the two parts of the ocean on soundings being shown, a large mass, distinguished as "green water" is really placed as it were between the poles of a gigantic single galvanic circle: and we are thus enabled to explain many anomalous decompositions taking place within such limits.

In looking for the cause of the transfer of sulphur from its oxidised state, in saline compounds, to the metals on the bottom of the ocean, I have concluded that the waters from the land exert a most important influence. These waters are never destitute of organic matter in a changing state. This matter, dissolved from the surface of the earth, or from rocks in percolating the strata, assumes a state in which it powerfully attracts oxygen. Waters holding this matter in solution readily decompose sulphates of lime and soda, and even when partially exposed to atmospheric air. The line at which the saline waters of the ocean and the under-land flow of water meet is the place where observations have shown

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that the greatest chemical action exists. Ordinary decompositions of sulphates by organic matter in ocean water are hardly known to take place. The phænomena at once become distinct when land-waters are allowed to mix, and the water from deep wells in the vicinity of the ocean has a more highly marked chemical action than rain-water. The decomposition of the sulphate proceeds under the presence of carbonic acid, and carbonates of the alkaline earths are products of the change.

ON SOME SALTS OF ARSENIC ACID.*

BY M. KOTSCHOUBEY.

M. KOTSCHOUBEY has investigated compounds of arsenic acid with the alkalies and alkaline earths. For the estimation of arsenic acid he used a method exactly similar to that described by Raewsky for the quantitative determination of phosphoric acid.

The salts 2 PO, HO, AsO^5 and 2 SoO, HO, AsO^5, were obtained by treating arsenic acid with the corresponding carbonates. According to M. Kotschoubey, the soda salt crystallises with 26 equivalents of water of crystallisation. This differs from the statements of Mitscherlich, who found in it 24 equivalents, as in the ordinary phosphate of soda. The salt 2PO, HO AsO^5 is deliquescent, and does not crystallise. Like the soda salt, it fuses at a tolerably high temperature, without undergoing decomposition.

To prepare the salts 3PO, AsO^5 and 3SoO, AsO^5, arsenic acid is fused with an excess of nitrate of potassa or soda. The author's analyses confirm the composition of the acid salts, assigned to them by Mitscherlich.

The following double salts were obtained by admixture of the neutral salts:

PO, NaO, HO, AsO^5+18HO
So, AmO, HO, AsO^5+ 8HO
PO, AmO, HO, AsO^5+ xHO

Mitscherlich found in the arseniate of potassa and soda 16 equivalents water.

By carefully heating the ammoniacal double salts, the author believes that he obtained a form of arsenic acid analogous to metaphosphoric acid; but its rapid transformation into the tribasic variety prevented closer examination.

The compounds of arsenic acid with the alkaline earths were found to correspond exactly with the phosphoric acid compounds analysed by Raewsky. 2CaO, HO, AsO^5+3HO is obtained in the form of a crystalline precipitate when a solution of neutral arseniate of soda is poured drop by drop into a solution of chloride of calcium. 2CaO, HOAsO^5 +3HO, is obtained when, on the contrary, a solution of chloride of calcium is poured into a solution of arseniate of soda. The salt 3CaO, AsO^5+3HO is formed when the precipitation is effected with the addition of ammonia.

By supersaturating with ammonia a solution of the neutral salt, 2CaO, HO, AsO^5, in hydrochloric acid, a salt was obtained having the formula 2CaO, AmO, AsO^5+ 12HO, corresponding to the arseniate of ammonia and magnesia. By adding an excess of arseniate of soda to chloride of calcium a salt was obtained with the formula 6CaO, AsO^5+6HO, which, at 248° F., parted with the whole of its water, leaving the anhydrous compound 6CaO, As O^5.

By precipitating a hot solution of arseniate of soda with chloride of strontium and chloride of barium, crystalline precipitates were obtained, which, dried at 212° F., possessed a composition corresponding to the formulæ 2BaO, HO, AsO^5+2HO, and 2SrO, HO, AsO^5+3HO.

By the addition of arsenic acid to acetate of magnesia, or by precipitating sulphate of magnesia with arseniate of soda, a salt of magnesia was obtained, of the formula 2MgO, HO, AsO^5 +13HO which on washing with much water gave up some of its acid, producing the basic salt 3MgO, AsO^5.

* *Journal für Prakt. Chemie.*

ON THE VOLATILE FATTY ACIDS OF THE URINE.*

BY M. STADELER.

THE knowledge of the composition of the tissues and humors of the animal economy has made considerable progress of late years. It may be said that, most of the principles existing in the organism are known and have been studied with some attention. There are, however, some substances, which occur in small quantity in the economy, and of which the knowledge is not much advanced. In a physiological as well as in a chemical point of view, these must not be regarded as less interesting. For a matter, of which an excreted fluid, the urine, for example, contains only small quantities, is, perhaps, the residue of some important reaction which has taken place in the organs and which has left only slight traces, but full of significance to an attentive observer. In this point of view, it is good

* *Annalen der Chemie und Pharmacie.*

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to notice all facts which are of a nature to increase and render more accurate our knowledge concerning the composition of humors, and it will doubtless be found that the following analysis of a work by M. Stadeler on the fatty volatile acids of the urine is not without interest, although the data furnished by the author have not yet all the accuracy which science has a right to expect.

M. Stadeler has found in the urine of man and of the herbivora two series of volatile acids and a neutral nitrogenous body.

All urine does not contain these substances in equal quantity. The urine of the herbivora contains more of them than human urine. The author extracted it from the urine of the cow. For that purpose, 80 pounds of urine were mixed with milk of lime, the liquor was boiled, and then filtered and evaporated to one-eighth of its original bulk. The liquid evaporated and filtered was supersaturated with hydrochloric acid after having been cooled, and crystallised hippuric acid was separated from the acid mother liquors. From these mother liquors, the volatile substances which the urine contains in small quantity, may be extracted by successive rectifications and distillations. About 30 grammes of a yellowish liquid were obtained, of very disagreeable odor, which separated at once from the condensed water in the receiver. This oily product having been distilled with potassa was dissolved and combined partly with the alkali, whilst there was obtained in the receiver a light neutral oil, of a yellow color.

This oil, whose odor resembles that of a mixture of essence of rosemary and essence of marjoram, is not found ready formed in the urine, but appears to be the result of the action of potassa on the oil, in the first instance separated from the urine. It is nitrogenous, and dissolves in concentrated sulphuric acid, coloring it of a deep brown. The author obtained it in too small quantity to be able to submit it to an attentive examination.

The potassa which had served for separating this neutral oil, was left in the retort, combined with various volatile acids, among others, with benzoïc acid produced by the decomposition of hippuric acid. To separate the benzoïc acid, five-sixths of the potassa employed were saturated with sulphuric acid, and the liquid was submitted to distillation until the distilled product was no longer precipitated by the subacetate of lead.

The liquid obtained was submitted to repeated distillations with sea salt until the greater part of the acids dissolved in water were separated in the insoluble state. The odor of the oily products was that of hydrate of phenyle, but as their reaction was very acid, it was evidently a mixture. To separate the really acid bodies, this mixture was treated by carbonate of soda, and the portion which did not combine with the soda was extracted by ether. The ethereal solution was mixed with potassa, and the ether was separated by distillation. To separate *de novo* the oil combined with the potassa, it was sufficient to supersaturate the solution with bicarbonate of potassa. After having been dried, this oil was rectified. The boiling point of the liquid was rapidly raised from 248° F. to 356° F., and remained stationary at 383° F., when the greater part of the product had distilled over. The volatile part from 248° F. to 356° F. contained principally hydrate of phenyle and water. Afterwards, the hydrate of phenyle which passed over was found mixed with another body richer in carbon and hydrogen, which the author proposes to call hydrate of tauryle or taurylic acid. He admits that phenylic acid or hydrate of phenyle containing $C^{12}H^6O^2$, the composition of taurylic acid is represented by the formula $C^{14}H^8O^2$, which, as is evident, differs from the first only by C^2H^2. According to this, phenylic and taurylic acids would be two homologous bodies. It is to be desired that this interesting result should be speedily verified by accurate analyses and an attentive study of the properties of taurylic acid. Hitherto, the author has only proved that the boiling point of this acid is at least 18° F. higher than that of hydrate of phenyle, and that by mixing taurylic acid with sulphuric acid a conjugate acid is obtained which he calls sulpho-taurylic acid.

The solution of the salts of soda from which ether has separated the phenylic and taurylic acids, contained other volatile fatty acids which were isolated by distilling their salts of soda with sulphuric acid. The distilled liquor exhaled the odor of butyric acid and formed two layers. The lower layer was an oily and acid liquor, and the upper layer was an aqueous solution of these fatty acids. The author tried to separate them from each other by combining them with baryta, and crystallising the salts of baryta. The salt which he obtained in greatest quantity contained 39·13 per cent. of baryta; and was formed by a new acid which he calls *damaluric acid*. The composition of damaluric acid is expressed, according to M. Stadeler, by the formula $C^{14}H^{12}O^4$. Consequently, it differs

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from œnanthylic acid only by $C^{14}H^{14}O^4$, containing two equivalents less of hydrogen, and is to this acid what acrylic acid, $C^6H^4O^4$, and angelic acid, $C^{12}H^{10}O^4$, are to propionic acid $C^6H^6O^4$, and to valerianic acid $C^{12}H^{12}O^4$. Mr. Stadeler regards as probable the existence of a series of homologous acids of the formula

$$C^nH^{n-2}O^4.$$

Besides damaluric acid, the study of which does not appear to have been carried very far, the author discovered, among the acids forming the salts of baryta which he obtained, another acid, of higher atomic weight, to which he has given the name of damolic acid.

He concludes his memoir with some considerations relative to the origin of the various acids which he has discovered in the urine. As phenylic acid is formed by the transformation of various terms of the salicylic series, it is not improbable that these are salicylic combinations (hydroguret of salicyle, salicine) introduced by the aliments which give rise to the formation of phenylic acid in the system of the herbivora. The presence of phenylic acid in the castoreum, discovered some time ago by Wöhler, is a fact which appears to support the opinion advanced by the author. The beavers find, indeed, in the bark of the willow and poplar on which they feed, an abundant source of salicine, which, doubtless, serves for the formation of hydrate of phenyle.

With respect to taurylic acid, it is not impossible that it is formed by the transformation of some term belonging to the benzoïc series.

RESEARCHES ON COBALT.*

BY E. FREMY.

I HAVE the honor of submitting to the Academy some new facts concerning cobalt. All chemists are aware that certain metallic oxides are capable of being combined with ammonia to form new bases, in which the properties of the oxides and of the ammonia are completely disguised. The bases produced by the action of ammonia on the protochloride of platinum present an interesting example of these ammoniacal compounds. The object of the work, the principal results of which I now communicate, is to prove that the oxides of cobalt, containing more oxygen than the protoxide, are capable of combining with ammonia, forming new series of salts having, as their base, ammonia, oxygen and cobalt.

The mode of producing these compounds is easy of comprehension. When a salt of cobalt is acted upon by ammonia, the liquor does not become colored when preserved from contact with the air; but when it is exposed to the influence of oxygen, it immediately acquires a brown color, absorbs this gas with rapidity, and frequently deposits crystals, which are remarkable for their regularity. The salts produced in this reaction have for their base ammonia combined with the oxides of cobalt. As cobalt combines with oxygen in several proportions, the same salt, submitted to the action of ammonia and oxygen, is capable of producing several saline compounds containing ammonia combined with cobalt of different degrees of oxidation; thus, nitrate of cobalt, rendered ammoniacal and then exposed to the influence of atmospheric air, deposits successively three crystalline salts differing in their properties, and in which the proportion of oxygen is progressively increased.

These new salts frequently present very remarkable properties; thus, the first compound, which crystallises when the ammoniacal nitrate of cobalt is oxidised by exposure to the air, is decomposed, with effervescence, in cold water, disengaging pure oxygen.

The study of the products which result from the decomposition of the salts of cobalt, whose mode of formation I have just described, is highly interesting; for, on submitting the salts which contain most oxygen to the action either of boiling water or of dilute acids, they lose a portion of the oxygen which they had absorbed in the presence of the ammonia; and in this manner perfectly crystalline salts, having for base the intermediate oxides of cobalt are produced.

It is known that the composition of these oxides of cobalt is not yet distinctly fixed: by causing them to enter into definite and crystallised combinations I shall easily dispel the uncertainties in which their nature is involved; and this I am now about to do.

* *Comptes Rendus*, April 7, 1851.

ON THE OXIDATION OF AMMONIA IN THE HUMAN BODY, WITH SOME REMARKS ON NITRIFICATION.*

BY HENRY BENCE JONES, M.D., F.R.S.

THE author having shown, in a paper lately communicated to the Royal Society,

* Read before the Royal Society, January 30, 1851.

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that the effect of tartrate of ammonia on the acidity of the urine was totally different from that of tartrate of potassa, and that carbonate of ammonia, taken in very large quantities, did not produce any alkaline reaction of the urine, but that, on the contrary, the acidity was rather increased than diminished by such doses, repeated the experiments with carbonate of ammonia, hoping to obtain more decided results. Although, from these experiments, it was again apparent that no diminution of the acid reaction resulted from taking carbonate of ammonia, yet the fact of any great increase in the acidity of the urine could not be determined. In his former paper, the author suggested that an inquiry into the occurrence of nitric acid in the urine would probably give the solution of this unexpected effect of carbonate of ammonia; and he was led to undertake the experiments described in the present paper with the view of detecting the presence of that acid under particular circumstances.

The indigo test for nitric acid being more delicate than the protosulphate of iron test, it was chiefly employed; but a mixture of starch with a drop or two of hydriodate of potassa and hydrochloric acid was found to be a far more delicate test than either. Beginning with 10 grains of nitrate of potassa, added to 10 ounces of urine, it was found at last that as little as 1 grain of nitre to 10 ounces of urine could be detected with the greatest certainty and clearness when the starch test was used; but this quantity could not be detected as surely by the indigo test.

Experiments are described in which carbonate of ammonia was given, in doses varying from 40 grains to 7 grains, to a healthy man in whose urine no nitric acid could previously be detected; and the urine was tested at intervals of several hours after each dose. From these it appears that 10 grains was the smallest quantity that gave decided evidence of nitric acid by both tests.

Having satisfied himself that when carbonate of ammonia was taken small quantities of nitric acid passed off in the urine, the author made similar experiments with tartrate of ammonia, administered in doses of 60 and 40 grains; and in each case the starch test gave evidence of the presence of nitric acid in the urine some hours after. Similar experiments with the muriate of ammonia are next described; and in these the presence of nitric acid in the urine was readily detected three hours after the administration of the dose, even when it was so small as 10 grains.

From an experiment described in the paper, it was shown, that by a simple combustion of ammonia out of the body, as well as in the body, nitric acid was produced. From other experiments it appears that urea, also, by oxidation, whether out of the body or in the body, gives rise to nitric acid.

Having found that nitric acid was produced more readily and frequently than had been supposed to be the case, the author was led to try whether combustions in the atmosphere without ammonia could not give nitric acid. The presence of this acid was, in consequence, detected in the products of the combustion of alcohol, of coal, of a wax candle, and of hydrogen.

As this led to the supposition that nitric acid existed in rain-water at all times, experiments were made on the rain-water collected on wet days in London, and the presence of nitric acid was discovered by the starch and also by the indigo test.

The conclusions the author comes to from his experiments are:—

1. That the action of oxygen takes place in the body, not only on hydrogen, carbon, sulphur and phosphorus, but also on nitrogen.

2. That in all cases of combustion, out of the body and in the body, if ammonia be present, it will be converted partly into nitric acid.

3. That the nitrogen of the air is not indifferent in ordinary cases of combustion, but that it gives rise to minute quantities of nitric acid.

He further remarks, that the production of nitric acid from ammonia in the body adds another to the many instances of the action of oxygen in man; and that the detection of nitric acid in the urine may lead to the conclusion, that the blood is being freed from ammonia, or from substances closely related to it, as urea, or possibly caffeine and other alkaloids.

ON THE DOULE SALTS WHICH THE ALKALOIDS FORM WITH MERCURY, AND ON A NEW ALKALOID OF OPIUM.*

BY M. F. HINTERBERGER.

M. HINTERBERGER has prepared and analysed the compounds formed by the hydrochlorates of quinine, cinchonine, piperine and morphine, with chloride of mercury.

DOUBLE HYDROCHLORATE OF QUININE AND MERCURY.

To obtain this, equal portions of pure

* *Annalen der Chemie und Pharmacie.*

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quinine and of corrosive sublimate are dissolved separately in alcohol, the quinine solution is supersaturated with hydrochloric acid; the two solutions are mixed. After some time a granulated and crystalline precipitate forms in the liquor; this is the double salt. After washing it in cold alcohol, M. Hinterberger submitted it to analysis and obtained results which accord with the formula

$$C^{20}\ H^{12}\ NO^2,\ HCl,\ HgCl$$

This analysis confirms the formula $C^{20}\ H^{12}\ NO^2$ which M. Liebig long since proposed for quinine.

DOUBLE HYDROCHLORATE OF CINCHONINE AND MERCURY.

It is easily prepared by operating as described for the preceding salt. The double salt precipitates very easily from the alcoholic liquor, for it is almost insoluble in cold water, in alcohol and ether. It dissolves very easily in boiling water, and in hot aqueous alcohol. It contains, according to the analysis of the author

$$C^{38}\ H^{22}\ N^2O^2,\ HCl,\ 2Hg\ Cl.$$

The formula $C^{38}\ H^{22}\ N^2O^2$ is that adopted by M. Laurent for cinchonine.

DOUBLE HYDROCHLORATE OF PIPERINE AND MERCURY.

To obtain this combination, 1 part of piperine is dissolved in strong alcohol acidulated with hydrochloric acid; an alcoholic solution of 2 parts of chloride of mercury is added, and the mixture left to itself for several days. Crystals of the double salt are soon formed in the liquor, and gradually increase in quantity. These are separated from the water and washed with absolute alcohol. They are brilliant and of a yellow color, and at 212° F. they lose neither their brilliancy nor transparency. According to the author's analyses they contain:

$$C^{70}\ H^{37}\ N^2O^{10},\ HCl,\ 2Hg\ Cl + 2HO.$$

DOUBLE HYDROCHLORATE OF MORPHINE AND MERCURY.

It is obtained like the preceding compounds, under the form of an abundant white and crystalline precipitate. This double salt may be purified by dissolving in hot alcohol, from which it is deposited on cooling in the form of bracteæ. Water, alcohol, and ether do not dissolve it. Hydrochloric acid dissolves it at the ordinary temperature. The solution evaporated over a vessel containing lime sometimes deposits the double salt in voluminous crystals. According to the analyses of the author its composition is represented by the formula.

$$C^{34}\ H^{19}\ NO^6,\ HCl,\ 4\ HgCl.$$

In concluding his work, M. Hinterberger announces that having tried to prepare with the narcotine of commerce, compounds analogous to the preceding, he has proved that the alkaloïd employed contains only a small quantity of narcotine, and that it is principally formed of a new alkaloïd of opium. A single crystallisation enabled him to obtain this new alkaloïd perfectly pure. He proposes to give it the name of *opianine*, and represents its composition by the formula

$$C^{66}\ H^{36}\ NO^{23}.$$

He promises to return in detail to the properties of this substance, in a future memoir.

OBSERVATIONS ON THE URINE IN PNEUMONIA.*

BY DR. REDTENBACHER.

In the year 1846 Dr. R. was engaged in making a series of experiments on the urine of patients laboring under several acute and chronic diseases, with the view of determining,—first, the relation which subsists between the presence of inorganic salts and the specific gravity of the urine; and, secondly, whether the increased or diminished proportion of these saline constituents is connected with the formation or retrocession of certain morbid processes. His observations were made in Skoda's wards in the Great General Hospital of Vienna. He found that the quantity of inorganic salts was not subject to much variation, and consequently affected the density of the urine in a very trifling degree; but that its density depends upon the organic compounds, and especially upon the urea and uric acid. In cases of pneumonia, he has satisfied himself that the amount of chlorides in the urine undergoes variations dependent upon the stage of the disease. Healthy urine, as is well known, deposits a copious precipitate on the addition of nitrate of silver. Redtenbacher asserts that in all the cases of pneumonia (amounting to 80) in which he has applied this test, the faintness or absence of the precipitation has indicated a diminution or absence of chlorides. The precipitate becomes less distinct from day to day, till resolution commences,

* *Zeitschrift der k. k. Gesellschaft der Aertze zu Wien*, August, 1850; and *Edinburgh Monthly Medical Journal.*

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when the chlorides again gradually resume their normal proportion. Diminution of the chlorides likewise occurs in typhoid fever, in acute arthritis, and in capillary bronchitis; but is neither a constant phænomenon in these diseases, nor observed at any certain period of the morbid processes. In cases of tubercular infiltration, chlorides are found in the urine in normal proportion, but suffer diminution for a short time during each fresh infiltration.

Redtenbacher anticipates the objection as to the value of these observations, that the amount of the chlorides of the urine depends on the amount of culinary salt used with the food, and that the quantity of the former will be diminished with the supply of the latter; first, by showing that the chlorides are not equally diminished in the course of other diseases in which restricted diet is rigidly enforced; and secondly, by mentioning that Skoda's cases of pneumonia, on which his observations were made, were, from the beginning to the end of the disease, allowed a drink acidulated with muriatic acid. He believes, consequently, that the uniform diminution of chlorides in the urine of pneumonia is in some way essentially connected with the morbid process.

ON ENARGITE.*

BY MM. BREITHAUPT AND PLATTNER.

THIS mineral constitutes a very abundant ore of copper, which is worked at Morococho, in the district of Jouli, in the Cordilleras of Peru. It occurs there generally in compact masses, sometimes containing crystalline druses, and forming a vein in a crystalline limestone accompanied by Tennantite and copper and iron pyrites. This mineral has a rather brilliant metallic lustre, analogous to that of oxide of manganese (acerdese or manganite); its color is black, and so is its powder. Its crystalline form appears to belong to the right rhombic prism; the crystals have generally the primary prism based and truncated upon the vertical edges parallel to the diagonal planes. The angle of the prism could be accurately measured; it is 98° 11′. M. Breithaupt observes, that such a prism may be derived in a very simple manner from a prism of 120°; it would then have the formula $3a : 2b$; this, however, is merely accidental, as the crystals do not exhibit the conditions of symmetry which would pertain to a regular hexagonal prism.

Enargite exhibits two perfect cleavages parallel to the faces of the primary prism; there are likewise distinct cleavages in the direction of the diagonal planes, and an indistinct cleavage in the direction of the base. The fracture is uneven; it is brittle and easily pulverised; hardness exactly equal to that of calcareous spar; specific gravity, 4·430 to 4·445. It is readily distinguished, according to M. Breithaupt, by the perfect nature of its two prismatic cleavages, and by their angle, which may be measured with the greatest precision with the reflective goniometer.

Heated in a closed tube, this mineral decrepitates violently, furnishes a sublimate of sulphur, then fuses into a globule below a red heat and loses more sulphur, accompanied by sulphuret of arsenic. Heated in an open tube, it gives off sulphurous acid and oxide of antimony. On charcoal it disengages sulphuret of arsenic, and forms a deposit of arsenious acid, oxide of antimony, and oxide of zinc. After being roasted, it gives with borax the reactions of copper and iron. M. Plattner obtained on analysis the following results:—

Sulphur	32·222
Arsenic	17·599
Antimony	1·613
Copper	47·205
Iron	0·565
Zinc	0·228
Silver	0·017
	99·449

This mineral is therefore essentially composed of a sulphoarseniuret of copper, in which the relation of the equivalents of sulphur, arsenic and copper, is almost exactly as 8 : 1 : 6. Such a relation, supposing the arsenic to be in the state of trisulphuret, requires the rather complicated formula 8 Cu S, $As S^3 + 2Cu^2S$, $As S^3$; but supposing the arsenic to exist in the state of pentasulphuret, we have the more simple formula $3Cu^2S + As S^5$.

* Poggendorff's *Annalen*, vol. lxxx. p. 388.

ON THE PROPORTION OF SULPHUR IN VOLATILE ORGANIC COMPOUNDS.*

BY M. DEBUS.

M. DEBUS recommends the following method of estimating the sulphur in sulphurous organic compounds. A mixture of chromate of potassa and carbonate of potassa or soda is first prepared by dissolving in water one equivalent of bichromate of

* *Annalen der Chemie und Pharmacie t. LVI, p.* 90.

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potassa and two equivalents of pure carbonate of soda, and evaporating the liquor to dryness. A mass of a citron yellow is thus obtained, formed of one equivalent of chromate of potassa and half an equivalent of carbonate. After pulverising, it is strongly calcined, and introduced into a sealed tube; it is left to cool out of contact with the air. To estimate the sulphur in the mixture there is introduced at the bottom of a tube arranged as if for making an organic analysis, a column of fused chromate on to which is poured the matter to be analysed. Above this is poured another quantity of chromate, and the mixture is made in the tube itself with the aid of a coarse iron wire, the end of which is bent spirally. The tube is then filled with chromate and it is heated to redness as though in making an analysis. When the whole contents of the tube are red hot, a current of oxygen gas is passed over the mixture for half an hour, it is then allowed to cool. The cleansed tube is then cut into pieces and introduced into a precipitating vessel, in which sufficient water is added to dissolve the calcined mass. Hydrocloric acid and alcohol are added to the liquor thus obtained, and it is gently heated to reduce the chromic acid into oxide of chrome. The green liquor is afterwards separated by filtration from the oxide of chrome insoluble in the acids, obtained during the combustion. It contains almost the whole of the sulphuric acid formed; the insoluble oxide may retain from 1 to 2 per cent. in the state of sub-sulphate. It is therefore necessary, not to lose this acid, to transform the oxide of chrome into chromic acid, by fusing it with a mixture of 1 per cent. of chloride of potassium and of 2 per cent. of carbonate of potassium, to dissolve the calcined mass in water, and to reduce the chromic acid by the means just indicated. This new chromic solution is mixed with the green liquor already obtained, and the sulphuric acid contained in the united liquors is precipitated by chloride of barium. The quantity of sulphate of baryta collected enables us to calculate the proportion of sulphur contained in the analysed matter.

Commercial carbonate of soda contains often 1 or 2 thousandths of hyposulphite of soda. It is necessary to purify it before employing it in this kind of analysis.

ON ATROPIA AND DATURIA.*

BY DR. A. VON PLANTA.

THE two alkaloïds have been carefully examined by Dr. Von Planta, who found them to agree entirely in chemical properties with each other. Both crystallize in loose colorless needles, which are permanent in the air, inodorous, heavier than water, very easily soluble in alcohol, but less so in ether, and still less so in water. One part of atropia requires 290 parts of water at ordinary temperatures for its solution. According to Geizer, daturia required 288 parts of cold, and 72 of hot water.

Both alkaloïds fuse at from 190° to 194° F, without losing in weight or being decomposed. At a higher temperature decomposition, with partial evaporation, takes place. The aqueous solution of each has a strong alkaline reaction. Both combine with sulphuric and hydrocloric acids, and form neutral compounds, which can be evaporated to the consistency of syrup, without showing any tendency to crystallize. These salts not only readily dissolve in water, but also in alcohol. In ether, however, they dissolve with difficulty. Ammonia and potassa and their carbonates occasion only in very concentrated solutions a pulverulent precipitate, which disappears again by an excess of alkali. Bicarbonate and phosphate of soda occasion no precipitate. Chloride of gold produces a crystalline precipitate of a sulphur-yellow color, which is but slightly soluble in hydrochloric acid. Chloride of platinum yields, with hydrochloric of atropia, a pulverulent precipitate, which conglomerates like resin, and is easily dissolved by hydrochloric acid. The same is the case with the hydrochlorate of daturia, but only when very concentrated; the precipitate does not easily dissolve in hydrochloric acid. Chloride of mercury produces only in very concentrated solutions a white pulverulent precipitate, which is readily dissolved in hydrochloric acid and in sal ammoniac. Hydrargyro-iodide of potassium occasioned with the hydrochlorate of atropia a very solid white caseous precipitate, which strongly conglomerated on the addition of hydrochloric acid. Iodide of potassium had no effect. The relation of the hydrchlorate of daturia to these agents is not stated by Planta. Sulphocyanide of potassium had no effect. Tincture of iodine produced in both a kermes-brown precipitate. Tannic acid and tincture of galls produced only, upon the addition of hydrochloric acid, a flocculent precipitate. Nitro-picric acid occasioned a sulphur-yellow precipitate.

The analytical results both of the free alkaloids and of their compounds with chloride of gold, are:—

* Buchner's *Repertorium*.

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ATROPIA.

	Planta		Equiv.
Carbon....	70·03	70·58 per cent	35
Hydrogen...	7·85	7·95 "	23
Nitrogen....	4·83	4·84 "	1
Oxygen.....	17·31	16.60 "	6
	100,00	100,00	

DATURIA.

	Planta.		Equiv.
Carbon.....	70·58	per cent.....	34
Hydrogen....	7·95	"	23
Nitrogen.....	4·84	"	1
Oxygen.....	16·60	"	6
	100,00		

ON EMERYLITE.*

BY DR. J. LAWRENCE SMITH.

THIS mineral, which belongs to the family of micas, is lamellar like mica; the plates are easily separated, and possess a little elasticity. Sometimes it is in the form of a mass composed of very small pearly scales, which are very friable, resembling some species of calc. The plates are commonly convex and concave, grouped in such a manner as to form a triangular prism. It is also found massive with a micaceous structure, but with an irregular fracture; the aspect of this variety is waxy: it comes from Gumuch-dagh. The crystalline form is difficult to determine; but to judge from the streaks on the surface, and the imperfect cleavage in two directions, it would appear to belong to an oblique rhombic prism.

Its color is white and lustre silvery; the hardness taken on a specimen from the Island of Nicaria is from 4 to 4·5. The specific gravity taken on ten specimens varies from 2·80 to 3·09; this difference is not remarkable in a lamellated mineral. It is not attacked by acids; heated before the blowpipe it emits a bright light, and melts with great difficulty on the edges, which assume a blue color if touched with the nitrate of cobalt and reheated. Heated in a tube it furnishes water, frequently having an acid reaction due to fluoric acid.

The composition of several specimens subjected to analysis is as follows:—

Localities.	Silica.	Alumina.	Lime.	Oxide of iron.	Magnesia.	Potash and soda.	Water.	
Gumuch-dagh	29·66	50·88	13·56	1·87	0.50	1·50	3·41	Smith.
Island of Nicaria...	30·22	49·67	11·57	1·33	trace	2·31	5·12	Smith.
Island of Nicaria...	29·87	48·68	10·84	1·63	trace	2·86	4·32	Smith.
Island of Naxos....	30·02	49·52	10·82	1·65	0·48	1·25	5·55	Smith.
Island of Naxos....	28·90	48·53	11·92	0·87	not estimated.	not estimated.	5·08	Smith.
Island of Naxos....	30·10	50·08	10·80	not estimated.	.....	1·50	4·52	Smith.
Gumuch-dagh	30·90	48·21	9·53	2·81	.....	.....	4·61	Smith.
Gumuch-dagh	31·93	48·80	9·41	1·50	.....	2·31	3·62	Smith.
Siberia.....	28·50	51·02	1 ·05	1·78	.....	not estimated.	5·04	Smith.
Village Green, U.S.	32·31	49·24	10·66	.....	0·30	2·21	5·27	Craw.
Village Green, U.S.	31·06	51·20	10·24	.....	0·28	2·97	5·27	Craw.
Village Green, U.S.	31·25	51·60	10·15	.....	0·50	1·22	4·27	Craw.
Village Green, U.S.	30·18	51.40	10·87	.....	0·92	2·77	4·52	Craw.
Unionville, U.S. ...	29·19	50·57	11·31	.....	0.72	2·47	5·14	Hartshorne.
Unionville, U.S. ...	32·15	54·28	11.36	trace	0·05	not estimated.	0·50	Silliman, Jun.
Buncome Co., U.S.	29·17	48·40	9·87	.....	1·24	6·15	3.99	

The oxide of iron may be regarded as an impurity which exists between the plates of the mineral. The composition of emerylite is represented by the formula—

$2RO, SiO^3+2(2Al^2O^3, SiO^3)+2HO.$

The most beautiful specimens of emerylite come from Naxos; and as the blocks of emery from this island frequently contain it, there will be no difficulty in procuring specimens for cabinets. It is often mixed with diaspore.

*Silliman's *American Journal*, Jan. 1851.

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ON THE PRESENCE OF IODINE IN CALCAREOUS ROCKS.

BY M. LEMBERT.*

HAVING been employed, in the commencement of the year 1849, to make an analysis of a ferruginous mineral water, I conceived the idea of seeking iodine in it, and I confess that I was surprised at finding it. I announced this result to several persons at Lyon, who expressed some doubts as to the reality of this fact. I made fresh trials, which only confirmed the first; but I was curious to discover the probable origin of this iodine, and on reflecting that this spring is situated in the proximity of the calcareous rocks which compose the system of the Mont d'Or, of Lyon, and that those rocks are rich in fossil debris, I sought in them a solution of this question. I tried several layers of the limestone, and especially the limestone à entroques (Couzon Stone), in which debris of marine polypi abound, and in this layer I found iodine. I cannot say what iodide it is that is contained in this limestone, but the following are the methods I employed to prove its presence.

1st. The stone, ground and sifted was treated with boiling distilled water, evaporated after filtration and reduced to a very small volume; it took a blue tint on the addition of starch and sulphuric acid.

2nd. The limestone having been pulverised and sifted, I saturated some sulphuric acid diluted with from ten to fifteen times its weight of water, with this powder; the liquor when filtered and reduced to a small volume by evaporation behaved in a similar manner to the preceding, only the quantity of iodine was larger.

Although it was improbable that the iodine could proceed from the water or the sulphuric acid, I have, nevertheless, for the sake of certainty, tried the distilled water which I used for it. I evaporated a quantity similar to that which I had used, and having reduced it to the same volume as before, I could find no traces of iodine. On the other hand I experimented on other limestones with the same sulphuric acid and in the same manner, and no iodine was found in it.

One fact appeared to me worthy of attention, that is the presence in this limestone of carbonate of protoxide of iron, and which appeared to me evidently to result from the following experiments:—

1st. If, after having saturated the sulphuric acid with limestone in such a manner that the liquor is still slightly acid, and having afterwards filtered it, carbonate of potassa or soda, or even of lime be poured into the liquor, there is instantaneously formed a greenish white precipitate, becoming afterwards rusty.

2nd. If, in this experiment, the sulphuric acid is replaced by the hydrochloric acid, lime poured into the filtered liquor gives the same result.

3rd. But, if nitric acid is employed, lime added to the filtered liquor immediately gives a rusty yellow precipitate.

This precipitate is evidently oxide of iron proceeding from a carbonate of protoxide contained in the limestone; only, that, in the first two cases, there was formed a salt of protoxide, and in the last, the protoxide of iron, became sesqui oxide by the oxidising action of the nitric acid.

After this time, having made a journey to Montpellier, I brought thence several samples of limestone for the purpose of seeking iodine in them. On the common of Saint Jean-de-Vedas there is a large bank of marine *miocene* very rich in fossil remains. I took samples from the upper layers as well as from the lower layers to which the quarrymen had reached. These two layers, tried as above mentioned, gave me different results The upper layer contained iodine, and the lower layer contained more, but what appeared to me remarkable was, that the layer which contained iodine, contained likewise carbonate of iron, and that I did not find any in that which did not contain iodine. We should be tempted to believe from this that the iodine is found in the state of iodine of iron; but the reason which makes me reject this opinion is that the precipitate protoxide of iron is in much more considerable quantity than would be necessary for forming an iodide with the iodine contained in the limestone. We may also remark that the couzon stone, which contains more iodine than the stone of Saint Jean-de-Vedas, contains more protoxide of iron than the latter.

The above facts appear to me likely to throw more light on the question of ferruginous waters, all or nearly all of which, as has been lately proved, contain iodine. I do not know if it be necessary to say that my experiments on the limestone *à entroques* date from the middle of the year 1849, and that at the end of the same year the Académie de Médecine having asked of me a report on the waters which fur-

* *Journal de Pharmacie et de Chimie*, April 1851.

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nished the subject of these observations, I included these same facts in that report, and mention was made of them in the report of the Académie of the 4th of June, 1850.

ON A NEW METHOD OF FORMING CARBONIC ETHER.*

BY M. ADOLPHE WURTZ.

It is known that M. Ettling obtained carbonic ether by making potassium react on oxalic ether. No other process has, so far as I am aware, been discovered, for the formation of carbonic ether, which it is impossible to procure by the processes which generally serve for the preparation of the compound ethers.

In studying, some years ago, the action which chloride of cyanogen exerts on alcohol, I noticed the formation of urethane in this reaction, which gives rise, at the same time, to a considerable quantity of hydrochlorate of ammonia. The formation of ammonia in this case indicates the complete decomposition of the elements of chloride of cyanogen C^2NCl by the molecule of water of alcohol C^4H^5O, HO, or else by water which is added to the mixture to aid in the reaction. At the same time, that the hydrogen of this water goes to the nitrogen and chlorine of the chloride of cyanogen, its oxygen combines with the carbon, giving rise to the formation of two equivalents of carbonic acid; it may readily be conceived that this carbonic acid, in the nascent state, in the presence of the molecule of oxide of ethule formed by the dishydratation of the alcohol, may combine with it to form carbonic ether. I have ascertained, indeed, that a certain quantity of carbonic ether is formed in this case. To isolate it, it is sufficient to mix with water the liquid resulting from the reaction of the chloride of cyanogen on dilute alcohol. An oily layer, lighter than water, is separated, which contains carbonic ether. On submitting this ethereal liquid to distillation, its boiling point gradually rose from 176 to 257° F. If we collect separately all that passes over at above 248° F. it is easy to ascertain that the liquid obtained is carbonic ether. It resembles this ether in odor, boiling point, and composition. This is placed beyond doubt by the following analyses:

I. 0·363 gr. of matter gave 0.675 of carbonic acid and 0·272 of water.

II. 0·4035 gr. of matter gave 0·750 of carbonic acid and 0·315 gr. of water.

These numbers give in hundredths:—

	Experiments. I	Experiments. II	Theory.		
Carbon	50·70	50·68	C^{10}....	60	50·81
Hydrogen	8·31	8·66	H^{10}....	10	8·47
Oxygen	,,	,,	O^6.....	48	40·72
				118	100·00

According to the foregoing, the reaction of chloride of cyanogen on alcohol is expressed by the following formulæ:—

$$\underbrace{C^2NCl}_{\text{Chloride of Cyanogen.}} + \underbrace{C^4H^6O^2}_{\text{Alcohol.}} + 2HO = \underbrace{C^6H^7NO^4}_{\text{Urethane.}} + HCl.$$

The hydrochloric acid may react on another portion of alcohol and give rise to the formation of a certain quantity of hydrochloric ether.

$$C^2NCl + 2C^4H^6O^2 + \underbrace{2HO = C^{10}H^{10}O^2}_{\text{Carbonic ether.}} + H^4NCl$$

RESEARCHES ON A NEW CLASS OF ETHERS.*

BY M. GUSTAVE CHANCEL.

In a communication which I had the honor of addressing to the Academy, I made known a process by means of which I am able to produce several ethereal combinations at present without analogy in chemistry. This process is based on the double decomposition of the sulphovinates and other vinic salts among themselves, without the influence of heat.

As the vinic salts are produced by the polybasic acids, such as sulphuric, carbonic, oxalic, succinic acids, &c., I hoped to obtain true double ethers with them, and I have not been disappointed. I have thus obtained double oxalates, carbonates and sulphocarbonates of ethyle and methyle, of ethyle and amyle, and of methyle and amyle.

I shall now briefly point out the principal characters of these bodies and the mode of preparing them.

The double oxalate of ethyle and methyle is obtained by distilling at a gentle heat an intimate mixture of equal parts of anhydrous oxalovinate and sulphomethylate of potassa. It is a colorless liquid which partakes of the properties of the oxalates of ethyle and methyle, standing between the two with regard to boiling point, density, &c. Boiling

* *Comptes Rendus*, No. 16, April 21, 1851.

* *Comptes Rendus*, No. 16, April 21, 1851.

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water completely dissolves it, decomposing it into oxalic acid and pyroxylic spirit. Ammonia instantly destroys it, giving a precipitate of oxamide. The analysis of this double ether leads to the formula

$C^5H^8O^4=C^2O^4EtMe=2vol.$

The double oxalate of ethyle and amyle is prepared in a similar manner, by the decomposition of oxalovinate of potassa with sulphamylate of potassa.

The double oxalate of ethyle and methyle is produced by a similar reaction, in submitting to a gentle heat a mixture of carbovinate and sulphomethylate of potassa. We thus obtain a colorless and limpid liquid, endowed with almost all the properties of ordinary carbonic ether, from which it differs only by its greater density and lower boiling point.

The same process may be employed in the production of carbonic ether itself, which, as is known, has hitherto been obtained only by the action of potassium on oxalic ether. I prepare carbonic ether by submitting to the action of heat a mixture of carbovinate and sulphovinate of potassa. My method is therefore applicable to the direct etherification of carbonic acid.

Finally, I have likewise obtained the double ether of sulphocarbonic acid.

The double sulphocarbonate of ethyle and methyle is very easily obtained in distilling an intimate mixture of xanthate of potassa and anhydrous sulphomethylate of potassa. It is a limpid liquid, of a pale yellow, of sweetish taste, and of a powerful ethereal, but not disagreeable odor. It contains:—

$C^4H^8OS^2=COS^2EtMe=2vols.$

It is known, from the interesting observations of M. Cahours, that carbonic ether is converted into urethane and alcohol under the influence of ammonia. In these circumstances the sulphocarbonate of ethyle and methyle is metamorphosed in an entirely similar manner, and gives, instead of normal urethane, sulphuretted urethane, and instead of alcohol, methylic mercaptan.

The *sulphuretted urethane* thus obtained occurs under the form of beautiful colorless prisms, fusible at 97° F., soluble in water, and especially in alcohol and ether. Its composition is represented by that of urethane in which half the oxygen is replaced by sulphur. It possesses, therefore, the composition and properties of xanthagmanide, described by M. Debus, and which he obtained by a perfectly different process.

This remarkable action of ammonia on sulphocarbonate of ethyle and methyle demonstrates the parallelism which exists between the carbonic and sulphocarbonic ethers, and between the alcohols and mercaptans.

The following is a synoptical table of the various combinations described in my two communications on this subject:—

(Me=CH^3, Et=C^2H^5, Ay=C^5H^{11}.)

Water.	Alcohol.	Neutral Ether.
2 vols.	2 vols.	2 vols.
Water.....OHH	Pyroxylic spirit.....OHMe	Methylic ether.....OMeMe
	Alcohol.....OHEt	Ethylomethylic ether...OMeEt
	Potato oil.....OHAy	Ethylic ,, ...OEtEt
		Amylo-methylic ,, ...OMeAy
		Amylo-ethylic ,, ...OEtAy
		Amylic ,, ...OAyA

Setting out from this table, it is sufficient to add to each of these formulæ:—

CO^2 to obtain the corresponding compounds of carbonic acid.
CS^2 ,, ,, ,, ,, ,, ,, sulphocarbonic acid.
C^2O^3 ,, ,, ,, ,, ,, oxalic acid.

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II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ADULTERATION OF COCHINEAL.

To the Editor of the Economist.

Some years ago the Customs authorities discovered that cochineal was largely adulterated, for the purpose of defrauding the revenue by claiming drawback on a spurious article. A successful prosecution was supposed to have put an end to the practice, while the article itself being now duty free, the inducement no longer existed as regards drawback. Nevertheless the adulteration is carried on more vigorously than ever, and is still on the increase. It appears from analysis, that the spurious matter consists of silica and alumin, and reaches upwards of 10 per cent. Of four samples cochineal placed in the hands of an eminent analytical chemist (Mr. Teschmacher,) two were known to be spurious and two genuine, and the following was the result:—

Sample marked No. 1. original grain Honduras, consists of—

98·50 parts of coloring matter, in combination with animal organic matter
1·50 parts of phosphate and muriate of potash and phosphate of lime

100·0 parts

Sample marked No. 2, colored grain Honduras, consists of—

89·0 parts of coloring matter, in combination with animal organic matter
3·50 of phosphate and muriate of potash and phosphate of lime
9·50 of silica and alumin

100.0 parts

Sample marked No. 3, original grain Mexican, consists of—

98·50 parts of coloring matter, in combination with animal organic matter.
1·50 of phosphate and muriate of potash and phosphate of lime

100.0 parts

Sample marked No. 4, colored grain Mexican, consists of—

89·50 parts of coloring matter, in combination with animal organic matter
1·50 of phosphate and muriate of potash and phosphate of lime
9·0 of silica and alumin

100·0 parts

From this examination, it is evident that samples No. 2 and No. 4 are adulterated to the extent of between 9 and 10 per cent., with silica, (earth of flints) and alumin (earth of clay), which although not injurious to the coloring matter of the cochineal, yet in a given quantity reduces its value to that extent.

Hence, there is every inducement to pursue the practice, which is, however, nothing but a direct robbing of the consumers.

It has already destroyed the direct Levant trade, which is supplied entirely by middlemen and manufacturers, the merchant exporting the genuine article being quite unable to compete with persons who can sell silica and alumin at the same rate as cochineal, with the additional advantage that damaged and inferior (genuine cochineal being adulterated) has a better appearance than the genuine article of a superior quality. The evil consequences of these dishonest practices cannot be better exemplified than in the fact that Bordeaux, which was once the great depôt for this article of commerce, has entirely lost the trade, and entirely owing to the loss of character by extensive adulteration. As regards the home consumer, he can effectually guard against this species of knavery by having his cochineal direct from the docks; but even this is a grievance, as few consumers can take off a sufficient quantity to be enabled to buy through the brokers. He must necessarily buy from the dealer who can adulterate or not, as his conscience and character allow him.

The position of the foreign consumer is seen in the facts stated. The remedy remains to be found, and if you can assist in this, you will confer another benefit upon many of your readers, and amongst them, your obedient servant,

ONE OF THE TRADE.

London, 14th May, 1851.

[We have taken this article on account

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of the facts it contains; and we have preferred leaving the nomenclature alone to correcting it.

The facts contained in this letter are decidedly beyond contradiction true, as we know from far better authority. Our object in inserting this letter is, to put our readers on their guard, and to recommend large buyers to have a sample analysed before payment for their purchases.]

ON THE MANUFACTURE OF SMALT.*

BY C. TOMLINSON.

This branch of manufacture is altogether foreign; and the chief material for it is almost entirely obtained from two small districts, one in Saxony, on the borders of Bohemia (visited by the author in 1847) and the other in Norway.

The use of the ore from which smalt is manufactured (termed by the miners of Schneeberg *cobalt*) was discovered by one Christopher Schurer, a glass-maker at Neudeck. He first collected some of this Schneeberg ore, and tried it in his glass furnace, when he found, to his delight, that it communicated to glass a beautiful blue color. This was about the year 1540, or perhaps earlier. Schurer made many trials of the new material, and at length succeeded in making of this blue glass *an enamel color*, well adapted to the use of the potter. This color found its way to Nuremberg, and at length to Holland, where it was highly appreciated by the Dutch artists. They sought out the humble glass-maker of Neudeck, and invited him, by large promises, to reveal his secret. He took up his residence for a time in Magdeburg, and had the ores of Schneeberg conveyed thither for the purpose of his manufacture. But he afterwards returned to Neudeck and constructed a hand-mill for grinding his glass to powder, and afterwards another, which was driven by water. Meanwhile the Dutch had become expert in the preparation of the color so that they obtained from 100*s.* to 120*s.* per cwt. for it, while the price in Saxony was only 22*s.* 6*d.* per cwt. At a later period therefore, the Elector of Saxony had to invite the color-makers of Holland to teach their methods to his people; after which, color mills rapidly increased in the neighborhood of the cobalt mines.

Thus fur a very long period this beautiful color continued to be manufactured from a mineral whose composition was unknown. It was not till the year 1733 that the Swedish chemist Brandt obtained from this ore the metal which he called *cobalt*, and proved that the coloring matter is the protoxide. In 1780 Bergman confirmed and extended Brandt's results: and in 1800 the subject was taken up by the School of Mines at Paris, and investigations were also carried on by Thénard and Proust.

Metallic cobalt is a brittle metal of a reddish-gray color,; it fuses with difficulty, and has a magnetic character. This metal has not been applied to any useful purpose in the arts, and the interest attaching to it is purely scientific. The native combinations of cobalt are the oxide, and compounds of the metal with iron, nickel, arsenic and sulphur.

To obtain the oxide in a state of tolerable purity requires much careful and laborious manipulation, varying somewhat according to the nature of the ore. The first process is *picking*, by which stony fragments are removed, and the ores are separated into different qualities; the richest being set aside for roasting, with little or no previous preparation, and those containing nickel being reserved for special treatment. The larger bulk of the picked ore is however subjected to the next process, which is *stamping* in a stamp-mill. Here a cam, or tappet-wheel, lifts up a number of pestles of pine-wood, shod with lumps of cast iron, and, suddenly releasing them, allows them to fall by their own weight upon the ore, which is distributed in chests beneath. The stamp-troughs are furnished with a stream of water, which washes out the pounded ore, and carries it down an inclined plane, where the sand and earthy matters, being much lighter than the metallic oxides, are carried furthest by the action of the stream, and are easily separated from the heavy and valuable particles. The ore thus washed is next *roasted* in a reverberatory furnace, provided with chambers for receiving and condensing the arsenic. The condensing tube is upwards of 100 feet in length, or a shorter tube is connected with chambers of several stories, where the arsenic (an important article in commerce) is collected by men wearing a dress fitting tightly in every part, a helmet with goggles for the eyes, and a wet bandage or sponge tied over the mouth and nostrils. They are still further fortified for their dangerous occupation by drinking a glass or two of olive oil. Their food also is regulated, and consists chiefly of vegetables, with abundance of butter. This is the system adopted in Silesia, at Reichenstein and Altenberg, where large quantities of arsenious acid, realgar and orpiment are manufactured from arsenical pyrites.

* *Proceedings of the Society of Arts.*

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In the roasting of cobalt, the ore is wetted and spread over the sole of the reverberatory furnace, in a layer 5 or 6 inches deep; it is then cautiously heated for six hours, during which time abundant fumes are produced, consisting chiefly of vapor of water and arsenious and sulphurous acids; and the heat is then increased, and continued for sixteen, eighteen or twenty-one hours, the ore being disturbed with a rake, to bring all parts under the action of the flame and of the air. When the ore becomes red-hot, the operation ends; the ore is then withdrawn, and the furnace allowed to cool before a fresh charge is put in. The sand which was separated in the dressing is sometimes mingled, in certain proportions, with the ore in the roasting; and the product thus obtained is the zaffre or saffre of commerce, a crude product. *Smalt*, on the contrary, is a valuable and carefully-prepared vitreous compound, a rich blue glass in fact, to be afterwards reduced to powder, and elaborated in the manner now to be described. Glass is well known to be a compound of silica and an alkali; but this compound is not very stable. If we reduce a piece of glass to powder by grinding in a mortar, a considerable quantity of alkali can be washed out; and even by moistening pounded glass with water, a piece of turmeric paper will detect the presence of free alkali. Silica and potassa, both very carefully prepared, calcined, sifted, and preserved from moisture, are mixed with oxide of cobalt, to form smalt, the proportions varying according to the commercial variety of the article required.

The ingredients are intimately mixed in a wooden trough, 2 feet deep; and then they are transferred to the melting pots, which are built up in a furnace heated to the proper temperature, each pot being first charged with an inferior blue glass in powder, called *eschel*, the effect of which is to give an interior vitreous lining to the pots. The smalt mixture is poured into the pots by means of iron ladles with long handles, and in about eight hours it fuses, and a vitreous crust is formed on the surface; this is broken through, and the mixture stirred by means of an iron tool, made red-hot for the purpose When the pots appear at a white heat, their contents are quite fluid, and the chemical combination of the materials has been effected.

When the glass attaches itself to the workman's rod, and can be drawn out into threads, it is ready for pouring; but it must first be carefully freed from two impurities, which interfere with the very dark homogeneous blue color which the glass ought now to present. These are, first, *glass gall* or *sandiver*, which forms as a scum on the surface, and can therefore be skimmed off; and secondly, the metallic impurities of the oxide, which sink to the bottom, but are sometimes met with in diffused globules throughout the lower portion of the glass pot. This sediment is of variable composition, but may contain cobalt, nickel, iron, arsenic, bismuth, and even silver. It is known in commerce by the name of *speiss*.

The pure glass is next taken from the glass pot in iron ladles; and as the object of subsequent processes is to reduce the glass to powder, that object is facilitated by emptying the ladles into vessels of water, the water being constantly renewed. The glass being at a red-heat when it first comes in contact with the water, is thus rendered, like Prince Rupert's drops, excessively brittle, granular, and easy to pulverize. When the glass pot is half empty, the workman examines the contents of his ladle to see if any speiss is there; if so, he manages to separate it from the blue glass by skilful pouring. All the glass pots are thus emptied before a fresh charge is given to any one of them; for so great is the reduction of temperature in charging three or four pots, that the contents of the others would become solidified or too pasty to be ladled. The charging of the six pots reduces the furnace to a brownish-red heat; and an hour and a half is required to get it up again to the proper temperature, which is that of an ordinary glass furnace.

The next process in the manufacture of smalts is the apparently simple one of reducing the blue glass to powder. But if we try the experiment of grinding to powder a portion of blue glass, we shall find that the substance, which by transmitted light had appeared so beautiful, is reduced in its disintegrated state to a light dingy powder; yet who can doubt that the same amount of coloring matter is present in the powder as in the glass? There are therefore difficulties to be overcome in converting a sheet of blue cobalt glass into a powder of an intensely blue color, and in obtaining all those shades and varieties of blue which are found in our manufactures. The processes are as follow:—The blue glass is first crushed in the dry state at a stamping-mill, then sifted to the size of ordinary sand, and this sand is afterwards ground in a mill between horizontal granite stones, in quantities varying from 1½ to 2 cwt. at a time. It is wetted with a little water, and the grinding is continued from four to six hours. The powder thus produced is then transferred to large

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vats full of water, and in the course of a very few minutes a separation of particles takes place in the powder. The heaviest, being those which are richest in cobalt, sink to the bottom; and this deposit constitutes one of the commercial varieties of smalts, known as *azure, coarse blue* or *streublau*.

The water which holds the finer particles of the powdered blue glass in suspension is drawn off into other vats, where it is allowed to subside for three-quarters of an hour or more, according to the variety of smalt intended to be produced; this second deposit is called *farbe*, the German word for *color*. The water drawn off from this second deposit is poured into vats, and allowed to remain for an indefinite time; and its deposit is called *eschel*, or *blue sand*. But the colors thus obtained are all again subjected to the action of water before they are fit for the market. Each deposit is agitated in tubs abundantly supplied with water, and is again allowed to subside, while any floating impurities are removed with a sieve. The water then drawn off is treated as in the former case, and the various kinds of subsidence form different varieties of color.

The glass of cobalt appears to be a mixture of the less fusible silicates, in which *cobalt* prevails, and which resist most perfectly the action of the water; and of the more fusible silicates, in which *potassa* prevails, and which are more susceptible of the action of water. The former silicates constitute the *azure*, or coarse blue: and the latter are partially decomposed by water, which subtracts a subsilicate of potassa, and leaves a supersilicate of potassa in a minutely divided state. *Farbe* owes its tints to the subtraction of potassa; and *eschel* contains more silica, and less potassa and cobalt, than the other varieties.

The beauty of smalt is said to be heightened by what may be called accidental causes,—the presence of 4 or 5 per cent. of arsenic and arsenious acids; from 6 to 9 per cent. of phosphoric acid; and minute particles of zinc, tin, antimony, and nitre. On the other hand, it is deteriorated by the presence of nickel, lead, iron beyond 10 per cent., bismuth, borax, soda, the alkaline earths, alumina, felspar, fluorspar and sulphur.

The precipitates of smalt dry into hard masses, which are crushed by mallets, then passed between cylinders, and sifted in fine sieves; the sieves are enclosed within a wooden case, and are set in motion by machinery. The azure is next dried in a hot room, under the tiled floor of which passes a winding flue. A number of shallow wooden troughs are arranged in this hot room, and the smalt is placed therein, and is stirred up from time to time with a rake. When sufficiently dry, it is taken to another room, where it is subjected to a final sifting, and the manufacture is complete. It is then slightly moistened, to prevent waste, and packed in small casks containing half a hundred weight each, and marked with the name of the shade.

NOTE ON A NEW PHOTOGRAPHIC PROCESS ON PAPER.*

BY M. H. BAYARD.

THE magnificent results recently arrived at in photography are universally admired, owing to the improvements introduced into the processes employed. The impressions obtained on paper have arrived at a vigor and harmony of tone which, added to the undisputable accuracy of the design, gives them a marked superiority over the productions of engraving and lithography. But heliography can compete advantageously with these two arts, only when, by easy means of reproduction, it is capable of forming of itself a really industrial and commercial branch of production.

We must not, therefore, be surprised that, at the present time, all the efforts of heliographic artists are directed towards this point; but a great obstacle has had to be surmounted, in the impossibility hitherto experienced, of obtaining, at will, in all weathers, and speedily, the positive reproduction of negative clichés on glass or paper.

The following has appeared to me to be the problem to be solved, viz.: *to render the positive paper very sensitive under the action of a relatively very feeble light*. I think that I have attained this object by the process which I am now about to describe.

The preparation to which I subject the positive paper is so delicate, that the reproduction of clichés may now be effected in one second in the sun, and in less than an hour by the light of a Carcel lamp. Between these two extreme terms, there is a margin which, as is evident, will render it easy to operate in all seasons, in all weathers, and at all hours of the day, either inside or outside of the house, and even if necessary, with artificial light.

But, independently of this application,

* *Comptes Rendus*, No. 15, April 14, 1851.

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there is another, which it is important to notice, viz.: that the paper prepared for obtaining positive drawings may likewise be used for producing negative drawings in the camera obscura, and, as they must be employed dry, heliographers will find themselves secure from the inconveniences which result from the employment of damp papers.

The following is the process:—

FIRST PREPARATION.

Dissolve, in a litre (quart) of distilled water:

1st Seven grammes* of iodide of potassium.
2nd Two grammes of bromide of potassium.
3rd Two grammes of sal ammoniac.
4th One gramme of cyanide of potassium.

The paper is steeped in this solution, sheet by sheet, and avoiding the contact of air bubbles; it is allowed to soak for at least a quarter of an hour, and is then hung up to dry. It is preferable to make this preparation hot, when paper made with a machine is used: it then impregnates much more equally and deeper, and we succeed still better, without heat, and with every kind of paper, by employing the pneumatic machine, as recommended by M. Regnault. The paper being quite dry may be placed in a portfolio for use as required.

The proportions of the salts may be varied, and other salts employed, provided always that the quantity of iodide of potassium be greatest. We may even, especially when using Whatman's English paper, dispense with this preparation, and expose the paper to the direct action of the vapor of hydrochloric acid, as we are about to describe; but, in this case, the preparation is less sensitive to the action of light.

SECOND PREPARATION.

10 or 12 grammes of iodine are added to 200 grammes of pure hydrochloric acid, and twelve hours after, the flask containing the mixture having been carefully shaken from time to time to facilitate the saturation of the acid by the iodine, 75 grammes of distilled water are added. When the liquid is cold, a sufficient quantity to cover the bottom is poured into a glass or porcelain capsule, with edges of the height of 5 to 6 centimetres; it is covered with a piece of ground glass, larger than the capsule, in order to prevent the vapors from spreading outside, then, taking a sheet of the iodised paper, which should be also greater than the capsule in order to rest easily on the edges; it is slipped under the glass, by raising one side and drawing it under.

The paper is left exposed to the acid vapor for four or five minutes, according to its thickness and the greater or less elevation of the temperature; then raising the glass, it is removed; it is shaken a little in the air, to dissipate the excess of vapor, and placed on a bath of a solution of nitrate of silver, (1 part of nitrate of silver in 12 parts of distilled water). Five or six minutes after this exposure, and as soon as the color produced on the paper has entirely disappeared, it is removed and dried by hanging it up by one corner.

The paper must be perfectly dry when exposed to the action of light. It retains its sensitiveness for several days. Exposed to the focus of Daguerre's normal object glass, it gives a negative image in four or five minutes in the sun.

The images are rendered visible by means of gallic acid according to the ordinary method, and it is fixed with hyposulphite, of soda after having been washed with several waters.

In support of my communication, I send several proofs which have all the qualities which the process is capable of affording: an unforeseen circumstance prevented me from presenting those which I had prepared for that purpose. But I shall soon have the honor of sending some others which will bear witness to the perfection of the heliography and of the advantage which may be derived from it in the reproduction of objects of natural history, either as regards anatomical preparations, or preparations for microscopical study, and for everything capable of aiding scientific labors. Amongst the proofs which I present, there are three which were obtained during one hour of exposure by the light of a Carcel lamp. They were made in the presence of several members of the Heliographical Society.

At the meeting of the 14th December, the Academy accepted the deposit of a sealed packet containing the description of the above process: I request it to order it to be opened.

The packet, when opened at the sitting, according to the request of the author, contained the following note:—

"A sealed packet, deposited by me in September, 1846, contains the description of a photographic process on paper, in the preparation of which I have since made

* 1 gramme=15·434 grains English.

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a modification to render it much more sensitive. This modification consists in applying to the paper, before any other preparation, a solution of iodide of potassium: 1 part of this salt in 125 parts of distilled water.

PHOTOGRAPHY ON PAPER. PHOTOGRAPHIC PRINTING.*

BY M. BLANQUART-EVRARD, OF LILLE.

HITHERTO photography has been excluded from the domain of manufacture; its products are too dear, and the processes which are used in their production, too long and too complicated for the establishment of manufactories similar to copper-plate or lithographic printing houses.

Under present circumstances, we cannot obtain more than three or four positive proofs in the day, with the same cliché, and further, each positive proof requires a treatment of several days. Besides, each proof sells at from 5 to 6 francs.

By the process which we are about to describe, each negative proof can easily give two or three hundred proofs in the day, which can be finished in the same day, and the cost of which would be only from 5 to 15 centimes.

Thus in a manufactory where thirty or forty clichés are daily at work, it would be easy to produce four or five thousand proofs in the day at so moderate a price as to enable the bookseller to have recourse to them for the illustration of his publications.

The new process is as follows:—

A thin paper is chosen, for the sake of economy; it absorbs less salt of silver. This paper should be prepared either with serum or albumen, according to the directions of our communication of the 27th May, 1850 (*Comptes Rendus, de l' Académie des Sciences*, No. 21, tome xxx).† It is better to prepare this paper a little before it is wanted, it prints more readily; besides it is still perfectly good after having been prepared for a whole year.

The paper is steeped in nitrate of silver, only supplying it with the quantity absolutely necessary to render it transparent. This effect being produced, it is plunged into a bath of gallic acid with the addition of from 5 to 10 per cent. of acetic acid. Thus steeped, it is deposited on a glass forming the bottom of a frame, and on this paper is placed the cliché which is to be reproduced. On the cliché is placed a second glass to press on it, and it is exposed to the daylight for from ten to twenty seconds, in the shade or even in the interior of an apartment. The paper is then replaced by another without delay.

The images collected from this exposure are completely formed; they complete themselves under the eye of the operator without any further means. Their perfect development requires from two to five minutes; very generally it is stopped at will by plunging the paper into a bath saturated with common salt.

The proof is then of a darker or lighter sepia tint; it can be turned black by treating it with a bath of hyposulphite acidulated by a few drops of acetic acid.

It is then sufficient to wash in pure water to remove the salts which have concurred in its formation.

We have given before now, means for strengthening weak proofs, and of decoloring those which are too deep in color.

The clichés on glass may be preserved from the action of the salts of silver, by covering them with a thick coat of picture varnish.

In order to employ clichés on paper and to dry the paper after soaking in aceto-nitrate of silver, if the paper is not to be immediately used, it would be beneficial to augment the proportion of acetic acid in the aceto-nitrate. Gallic acid would then be used only after the exposure. In a manufacturing point of view the clichés on paper should be transferred on to glass; their use would be very embarrassing. More easily altered, requiring a longer exposure, and three times as much care as those on glass, clichés on paper give at once less beautiful proofs, a less number in a given time, and at a much higher price.

The specimens which we join to this note show what a variety of shades the process described will produce; a variety which does not prevent regularity in the products when required.

* *Comptes Rendus*, No. 15, April 14th, 1851.

† See THE CHEMIST, New Series, vol. I., 502.

ON GUTTA PERCHA, CAOUTCHOUC, AND THE MILKY JUICE OF FICUS ELASTICA.*

BY DR. A. ADRIANI.

THE tree which yields the gutta percha has been repeatedly described by the name of *Isonandra Gutta*, of which specimens may

* *Central Blatt*, 1851, No. ii., p. 17, and *Pharmaceutical Journal*.

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be seen in the Botanical Garden at Kew. The manner in which gutta percha is obtained, is likely to exterminate this plant in the course of time. The trees, which reach the height of from 40 to 60 feet, and a diameter of 3 to 6 feet, are cut down close to the root, the bark peeled off, and the milky juice collected in pieces of bamboo-canes, cocoa-nut shells, &c. The milky juice is then inspissated by boiling, or, according to other reports, dried by exposure to the air. On the average, ten trees are required to obtain one picul=61·513 kilogrammes of gutta; 69,180 trees were therefore required to collect the 6,918 piculs, which, during the three years of 1845 to 1847, were exported from Sincapore alone.

The caoutchouc is gathered with greater care[1]; Edwards reports that two gallons of the caoutchouc milky juice were collected from 120 trees, and this could be repeated during many months. The milky juice of *Isonandra Gutta* appears never to have been imported to Europe until now. The chief trade in gutta percha is at Singapore. It is carried on by the Chinese, who adulterate it with the valueless juice of a tree, called *Getah Melabeöya*, which they import from Palembang. By this admixture, various sorts of gutta percha are obtained, which differ considerably in price.

EXAMINATION OF THE MILKY JUICE OF FICUS ELASTICA.

The author had the opportunity of examining the fresh milky juice of *F. elastica*, (from which, as from other species of *Ficus* caoutchouc is manufactured in the East Indies) from a plant of two-and-a-quarter metres high, which, even after extracting part of the juice, remains in a good condition in the botanical gardens of Utrecht. The milky juice was obtained by cutting off branches of leaf-stalks, and successively introducing the cut ends into small vessels, and allowing the juice to flow out. The author then found that, the nearer the part from which the milky juice was drawn was to the upper end of the plant, the greater was its proportion of water. That drawn from a terminal bud, contained 17·7 per cent. solid substance; that which issued immediately beneath the latter, contained 20·98; and that drawn from a leaf-stalk thirty centimetres above the ground, 25·15. Corresponding with this proportion, the milky juice from the upper parts appears to be less milky and more aqueous than that from the inferior parts. The fresh milky juice has an acid reaction, and under the microscope appears to consist of a clear, aqueous fluid, in which float a large number of globules of small diameter, and consisting of caoutchouc. By mixing the juice with water, no change takes place; on the addition of alcohol, a large number of small crystalline needles are precipitated, which unite in groups; ether causes the globules to unite, whilst the same needles are forming as with alcohol. Nitric acid produces a slight white precipitate, which is not redissolved by ammonia; ammonia or potassa colors the liquid yellowish; tincture of iodine colors the globules brown, and causes them to combine together to form larger viscid drops. Being dried on a glass plate, the juice leaves a membraneous coating behind, in consequence of the union of the caoutchouc drops.

The author found upon a continuous microscopic analysis, that the juice from the terminal bud consists of:—

Water	82·30
Caoutchouc	9·57
Resin, soluble in alcohol but not in ether	1·58
Of an organic acid, and a substance (sugar?) soluble in water and alcohol but not in ether	0·36
A substance soluble in water, becoming yellow by alkalis, (dextrin?) traces of	2·18
	100·48

The organic acid, whose magnesian salt is formed on the addition of alcohol and ether, crystals, does not appear to have any analogy with the known organic acid. Its most remarkable peculiarity is, that it forms, with potassa and soda, salts, which are of very difficult solubility, so that it yields with one part of a solution of carbonate of patassa in 200 parts of water, a considerable precipitate. The substance, which becomes yellow by potassa, could not be well determined; it is, however, neither vegetable albumen, nor any other so-called protein combination.

PROPERTIES AND COMPOSITION OF CAOUTCHOUC AND GUTTA PERCHA.

The specific gravity of lump caoutchouc was, at 20° C. = 0·9628; that of bottle caoutchouc = 0·9454. In determining these, the precaution was taken to remove the adhering water bubbles, by subjecting the caoutchouc to the action of an air-pump, which was also necessary in weighing gutta percha. The specific gravity of the latter, the author found to be = 0·999; without this precaution, it was only = 0·728. A specimen of gutta percha, mechanically purified and shaped in cakes, had a specific weight = 0·966.

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The author examined, in addition to this, various samples of gutta percha. One, denominated *a*, was in cakes of five to six inches thick, and was darker on the outside than in the interior; the second, *b*, was of a very loose structure, and was much contaminated with small stones, but agreed in color, which was in general flesh-red, with *a*; the third, *c*, was white, slightly inclined to brown. This last piece had been removed as an impurity, from a large block of gutta percha, but was found to be in quality equal to the best gutta, and was afterwards rolled out in the manufactory of Munich, Becke, and Co., into sheets of the thickness of paper, for address cards of that firm. The author obtained moreover, a sample of the *Getah Malabeöya*, imported from Palembang, and also a sample of gutta percha, adulterated with the latter. The getah, which appears also to be an inspissated milky juice, is much inferior to gutta percha; it is imported in the form of plates of two or three millimetres in thickness, of a greyish color, somewhat clammy to the touch, and brittle when dried. When cut, it is of a dirty white color, and contains many impurities. The vessel in which it was contained, developed on being opened a disagreeable acid smell. Treated like gutta percha and purified by hot water it was much darker than the raw substance, and often quite black; the smell is equally offensive, and its consistency similar to that of wax or glazier's putty. The gutta percha adulterated with the getah is of a loose structure, of a more greyish color, and of smell different to that of genuine gutta.

The water in which gutta percha has been boiled, (especially the sort *a*), assumes a brown color, and reacts as an acid. This was also observed by Soubeiran. After inspissation this reaction disappears, and seems, consequently, to proceed from volatile organic acid. On being evaporated a brown extract-like substance remained behind, which precipitates from the watery solution upon the addition of alcohol. Its quantity is very insignificant; in the specimen *b* it amounted, after three times boiling in water, to 0·042 per cent. of the weight of the gutta. That the gutta becomes discolored by being boiled in water the author did not find corroborated; on the contrary, it preserves its former color. The specimen *b* imparts to the water neither color nor acid reaction. Also from lump caoutchouc no ponderable quantity was extracted by water.

Gutta percha, treated by water and by cold alcohol yielded a resin, which was soluble in ether and volatile oils; the quantity amounted in sample *b* to 3·495 per cent. The gutta percha being then repeatedly boiled with alcohol, the latter extracted, besides an additional quantity of resin, a white fat, amounting to 12·035 per cent. The sample *c* yielded no perceptible quantity of resin, and but a small proportion of fat. From lump caoutchouc almost nothing was extracted by cold alcohol; boiling alcohol dissolved a light yellow very viscid resin of some smell and of a bitter taste, whose proportion amounted to 4.772 per cent.

After having been treated with alcohol, the gutta percha was further treated with hot ether, which extracted a resin much of the same smell as the gutta, and was in *a* of a dark color, in *b* similar to dry grape-sugar; its proportion was in *b* 13·610 per cent. The sample *c* yielded no resin to ether.

Having thus been treated by water, alcohol, and ether, rectified oil of turpentine was employed, in which the gutta was after a few days dissolved into a thick somewhat brownish liquid, which in a diluted state could be filtered through paper, to remove the impurities, and was then perfectly clear. One part of gutta percha requires for its solution from four to six parts of oil of turpentine. From this solution the gutta percha was obtained, by adding alcohol until the smell of the oil of turpentine had disappeared, as a beautifully white substance, possessing all the properties which characterise gutta percha. In the course of time, however, it assumed a darker color, and became at last yellow like straw, at the same time an acid smell developed itself similar to that of pine-resin, which originated very likely from some quantity of the oil of turpentine having been retained, which formed with alcohol, acetic acid.

The best means of obtaining the principal and essential parts of the gutta percha in a pure state is chloroform. The samples *a* and *b* were dissolved by it even when cold; *c* required hot chloroform. The solution is very thick and like a syrup, but can be filtered, if sufficiently diluted. From the filtered liquid the pure gutta percha is precipitated by alcohol, then washed with alcohol, and dried at 70° to 80°. The crude substance, must, however, before being dissolved in chloroform, be treated with water, alcohol, and ether. Sulphuret of carbon also dissolves gutta percha, which remains behind unaltered, when the solution is evaporated. At 70° to 80° it can be moulded with facility; at 110° it has the consistency of treacle; at 130° it forms an oily liquid, which congeals again when cold, and begins to be decomposed. The *Getah*

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Milabeöya is also dissolved by chloroform.

By the same treatment with chloroform caoutchouc can also be easily obtained in a pure state, and it then resembles externally very much gum Arabic. The author tried to reduce the gutta percha and caoutchouc by ammonia into an emulsion similar to the natural milky juice, but succeeded neither by the method of Summers nor by any other method. The ammonia as well as other alkalis had no other effect upon the gutta, except that of extracting from it coloring matter. Neither the purified gutta nor the caoutchouc contain nitrogen. In the crude gutta traces of it are found, and these are very likely contained in the extractive-like impurities. Neither could the author procure any so-called protein combination, as cosein (mentioned by Guibourt as a constituent of the crude gutta percha.) Vulcanised caoutchouc becomes brittle through the influence of the air, heat, and moisture, and Burke has, therefore, recommended sulphuret of antimony to be employed instead of sulphur for vulcanising. Gutta percha vulcanised with sulphur likewise loses its efficacy in the course of time. Vulcanised gutta percha contains 8·35 per cent. of sulphur, and caoutchouc 11·3 per cent. of this substance. It is remarkable that caoutchouc thus prepared is no longer soluble in chloroform.

By dry distillation, gutta percha yields, at 100° a yellow oil of a penetrating but not disagreeable smell. Between 120° and 200° yellow, offensively smelling oily substances are going off, which become darker in the air; at a still higher temperature the color of the very thin distilled product is more red or reddish-brown. Fifty grammes of gutta percha distilled in the sand-bath until nothing more passed over, yielded 28·83 grammes volatile oil, of spec. gravity 0·909; fifty grammes of caoutchouc, however, distilled in the same way yielded 42·884 grammes, which contained a considerable proportion of water, in consequence of an air dry substance having been employed, and the caoutchouc being able to retain more water than the gutta percha. Keat, in New York, manufactures the distilled product of gutta percha on a large scale.

The incinerated, crude, dried gutta percha (sample *b*) contained 5·18 per cent. of inorganic substances; the pure gutta treated with chloroform 0·314 per cent.; the crude caoutchouc 0·487 per cent.; that combined with chloroform 0·333 per cent. These substances consisted in the gutta percha of lime, oxide of iron, traces of potassa, magnesia, and silica. The bases were combined in the ashes with carbonic acid. The ashes of caoutchouc were similarly composed.

About the origin of *Getah Malaheöya* the author could obtain no further information. In warm water it became soft and sticky; being treated with boiling water it formed a neutral milky liquid, which was precipitated by alcohol. When boiled with alcohol it became glutinous, the alcohol extracting a white fat, resembling wax and resin; ether extracted also resin. Being dissolved in chloroform and filtered, a black coloring substance remained behind, which could not be dissolved by the usual solvents, and was burnt without leaving a residue. It appears to be nothing else but soot. The *Getah* melts at 170°, and becomes decomposed only at much higher temperature, when dark colored oils are distilled off.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in fixing colors, on fabrics made of cotton or other fibre. JOHN ROBERT JOHNSON, of Crawford-street, chemist. Patent dated October 17th, 1850. (A communication.)

THE first part of these improvements consists in the isolation or extraction of the coloring-matter of madder, and other rubiaceous plants, such as munjeet, so that it may be rendered fit and profitable to be fixed directly upon the fabric to be colored, without the use of the ordinary dyeing processes. The process by which this improvement is carried out, is by first, according to a well understood operation, to convert the coloring matter into garancine; and then when that conversion has taken place, the acid is removed by repeated washings until the liquor has no acid taste. An aqueous solution, which, when hot, will dissolve the coloring matter, and deposit when cold, is now to be added until no more coloring matter is taken up by the solution. This solution, when cooled, will deposit the coloring matter in orange flocks. In order to save as much material, labor, plant, &c., as possible, the patentee makes use of the same solution, over and over again, for taking up the coloring matter; and also, by the use of a worm-tube, passing through a vessel (a similar arrangement to a refrigerating-apparatus) he economises the heat from the hot solution, and applies it to raise,

* Collected from *The Mechanic's Magazine*, and *Patent Journal*.

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in a measure, the temperature of the solution which is to be applied hot. He effects this, by passing the cold solution through the worm-tube, contained in the vessel in which is the hot solution. There are many alkaline or earthy solutions, containing free sulphuric or hydrochloric acid, which have the property, more or less, of dissolving the coloring matter, when hot, and depositing it when cold. The chloride of lime, with free hydrochloric acid is a suitable example of these substances. However the patentee prefers a solution of potash-alum, with free sulphuric acid. The proportions he prefers are, ten pounds of alum, one pound and a half of sulphuric acid, and twelve gallons of water.

The madder extracted as above described, may be fixed upon the fabrics by printing with an aluminous cloth, and then steaming: as in the process of Fauquet and others. The patentee prefers another mode of operation.

The patentee is aware that the solvent properties possessed by alum for the coloring principle of madder, alizarin, has been known for many years; as has also been, the precipitating of the coloring matter from the solution by means of an acid. He considers this process to be far too expensive, and otherwise practically inapplicable, and disclaims it as any portion of his improvements.

The second improvement consists in a new mode of fixing the coloring-matter of madder, upon fabrics, by whatever way it may be produced, by mixing it with the mordant, and applying them both simultaneously to the fabric, prepared in the manner hereinafter described, and fixed there by steaming. On cotton unprepared, the color so applied yields readily to soap. The patentee has found, however, that it can be easily fixed, and rendered stable, by impregnating the cloth with a small quantity of oleaginous matter, as in the Turkey-red process commonly practised. Turkey-red cloth, however, is not found by the patentee to be suited to the operation, as it is rendered colored by the action of the alkali, and subsequent operations. The mixture which the patentee prefers to use for this purpose consists of:

White soap..... 5 lbs.
Gallipoli oil..... 5 lbs.
Water ..... 10 galls.

The soap is first dissolved in water, and the oil then added. This forms a mucilage, with which the cloth should be padded, then steamed, and put for eight and forty hours into a warm room to "age." It is then to be rinsed in water containing a small quantity of carbonate of soda (say one pound of carbonate to twenty gallons of water); and then washed and dried. A rinsing through hot soap, will partially produce the same effect. The use of an old piece of cloth which has been well worn, and frequently washed, perfectly answers the purpose, and shows how very little oleaginous matter is required to give stability to the combination of the alzarin and the base. Any salt of alumina used with the extract will have the effect of rendering the color more or less perfect. The mixture which the patentee employs for this purpose consists of:

Extract containing 10 per cent. of dry extract made into a paste, 10 parts.
Pure acetate of alumina, at twenty degrees of Twaddel, 1 part.

A little gum tragacanth is used for the purpose of thickening. The proportions here given may be considerably varied, without greatly modifying the result. However, when the quantity of alumina is increased beyond a certain point; say, for example, when twenty per cent. of alumina, at 25 degrees of Twaddel, are employed; then, the color ceases to be fixed, even on the oleaginous cloth; and when applied to fabrics, has the appearance of the lake-madders commonly used in printing. The substitution of a salt of iron for the alumina, modifies the color produced: giving from a chocolate to a black. When the color has been printed, the fabric should be hung up for a few hours; and then steamed for half an hour, at as low a pressure as possible. It is afterwards rinsed in water containing one-thousandth of its weight of an alkaline carbonate or phosphate. The "raising," may also be effected by the use of a solution of caustic alkali or lime; and it is found very advantageous, to perform a process of soaping on the fabric, after the "raising" and washing.

The third improvement relates to the printing of madder colors, by the common process of dyeing. In the ordinary methods of printing madders, a "branning" or "soaping" operation has to be performed several times, in order to clear the whites and brighten the colors; and, that the color may resist the cleaning process, an excess of madder is obliged to be employed; far beyond that necessary for the formation of the color. To obviate the disadvantages of this use of an excess of madder, the madder has been frequently treated by acids, and converted into garancine. This has the effect of clearing

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the whites and brightening the colors. Now the patentee has found, that the same results may be obtained, and in some hues, and for all as regards stability, very much superior results, without the use of garancine.

The method by which the patentee effects this, is:

First, by carrying out the dyeing process exactly in the ordinary manner, but with the use of at least twenty-five per cent. less madder, than is commonly used.

Secondly, by padding, by means of a padding-machine," or "pin-rollers," a bleaching liquid into the dyed fabric: the said fabric being then heated over the flue of the paddling-machine, or over the "tins" of the drying-machine in common use in these operations. Many of the bleaching preparations are adapted to this purpose; but the patentee prefers one consisting of a saturated solution of hydrochlorate of soda, formed by adding a solution of carbonate of soda to a solution of lime, until no more precipitate takes place. The madder extract may be applied in the ordinary manner to printing upon fabrics; but the patentee prefers first to treat the madder with hot water, for several hours, previous to its being used. During this operation the patentee has found that, in addition to the alizarin, pectic acid is produced; being continued in the mass, after the fermentation has taken place. The madder extract is very advantageously made use of, after this process of fermentation; for as no precautions for the regulation of the temperature are required to be taken, and a great deal of labor and time is saved.

The fourth improvement is for the application of the clearing process last described, to render spent madder available for use in brightening the colors, and clearing the whites, without subjecting it to the action of steam, or other similar action; that is to say, without converting it into garanrine.

The patentee finds that by subjecting the spent madder to the action of dilute acid, preferring hydrochloric acid (as in the process described, in a patent granted to Frederick Steiner,) and thereby removing the salts of lime, the spent madder becomes again fit for use. The addition of the acid is continued until all the salts of lime are neutralised: the washings being then found to be tasteless. Sufficient of an alkaline carbonate is then added to give a slightly red color; and the dyeing is carried on as with garancine. The colors are bright but the whites are bad in Steiner's process; but by this modification they are rendered very clear.

The last improvement consists in extracting a coloring matter from alkanet root; and in fixing the same. The root is digested in some cheap essential oil, such as turpentine, and a mixture of ammonia, with barytas is added. The earthy solution seizes upon the coloring matters, and sets the essential oil free. Acetic acid is then employed to neutralize the earth; the extract being thus isolated. When employed to print upon an aluminas cloth, it gives a fine color: and with the oleaginous cloth, a deep purple is obtained, which resists the action of soap, acid, and alkali.

The patentee claims:

First, the application of a solution of alum, with an excess of acid, or other acidified alkaline solution, which, by the simple abstraction and addition of heat, from one solution to the other as above described, for the extraction of the coloring matter of rubiacious plants to be fixed upon, cotton, silk, and other fabrics.

Secondly, the use of the oleaginous substance, as above described for the fixing of the coloring matter of madder, when applied topically, that is to say, by direct application.

Thirdly, the process as described above for the brightening of colors, and cleaning of the whites, in the application of madder to coloring; without the use of bran, soap, or garancine; and also the use of fermented madder, as above described, for the purpose of saving time and expense in the process of dyeing by madder.

Fourthly, the application of the cleaning process above described, for the purpose of obtaining bright colors, and clear whites, by the use of spent madder.

Fifthly, the extraction of the coloring principle of the alkanet root; and the fixing of the same as described.

Improvements in the manufacture and refining of sugar. DANIEL TOWERS SHEARS, of Bankside, copper merchant. (A communication). Patent dated Oct. 17, 1850.

The improvements here claimed comprehend:—

1. The application of apparatus which the patentee calls "rousers or displacers," for expelling from the vacuum-pan the sugar, when evaporated to such a state of dryness as to render its removal difficult by the ordinary methods; and also for mixing with the dry sugar the thick liquor which is

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introduced, to bring it to a state in which it may be easily removed.

2. A method of operating with the rouser, in which the cold water is passed through the steam pipes to prevent the sugar from adhering to them previous to its expulsion by the rouser.

3. Another method in which thick liquor is introduced at the bottom of the pan, and the ejection of the sugar commenced when a sufficient quantity has been allowed to enter to saturate the sugar.

4. The application of cold air to the vacuum-pan by means of a pipe, perforated with numerous small holes, to facilitate crystallisation.

5. A method of making refined sugar at one operation from beet-root and other saccharine juices, without the necessity of converting the juice into raw sugar. The juice is crystallised in very large pans, and the syrup is extracted by the centrifugal machine or otherwise from the crystals, which are afterwards reduced to the necessary consistence for introduction into the moulds, which are arranged in the centrifugal machine, with their apices pointing towards the circumference.

6. A method of maintaining the steam in the steam spaces of the vacuum-pan, at a uniform pressure.

7. A method of reducing West India molasses, khoar, or other saccharine substances, to a thin solution, and purifying and treating them for conversion into loaf sugar. Also a mode of crystallising to dryness West India Molasses, khoar, and other saccharine substances, either individually or in combination with each other, or with raw sugar, by continuing the operation of evaporation of the formation of the crystals.

8. The refining of sugars by the introduction into them of an alkali or alkalis, (prepared lime or wassama), and an acid gas, or gases, by preference, carbonic or sulphurous acid gas.

9. An apparatus for boiling sugar, consisting of three pans, the first of which is exposed to atmospheric pressure, and generates steam to supply the other two in which the sugar is boiled in a vacuum. The sugar is here concentrated to about 10° Baumé; in the second it is reduced to 25° or 27°; and in the last pan the operation is completed, and the sugar brought to "proof."

10. A system of carryiug on the process of evaporation, after the liquid has been brought to "proof," in order to obtain crystallised sugar therefrom in a state of dryness, using suitable means for keeping down the temperature, thus avoiding the usual method of crystallisation when the liquid is brought to proof.

Improvements in the treatment of certain bituminous mineral substances, and in obtaining products therefrom. JAMES YOUNG, of Manchester, Lancaster, manufacturing chemist. Patent dated Oct. 17, 1850.

This invention consists in treating bituminous coal in such a manner as to obtain therefrom an oil containing parafine (which the patentee calls parafine oil), and from which oil parafine is obtained. The coals best fitted for this purpose are such as are usually called parrot coal, cannel coal, and gas coal, and which are much used in the manufacture of gas for the purpose of illumination, because they yield, upon distillation at a high temperature, oleflantand other highly illuminating gases in considerable quantity, and although some of the coals last described contain a large amount of earthy matters, those matters do not interfere materially with the performance of this process. To obtain parafine oil from coals, the mode of procedure is as follows:—The coals are to be put into a common gas retort, to which is attached a worm pipe passing through a refrigerator, and kept at a temperature of about 55° Fahr. by a stream of cold water. The temperature of the refrigerator should not be made too low, lest the product of the distillation should congeal and stop up the pipe. The retort being closed in the usual manner, is then to be gradually heated up to a low red heat, at which it is to be kept until volatile products cease to come off. Care must be taken to keep the temperature of the retort from rising above that of a low red heat, so as to prevent as much as possible the desired products of the process being converted into permanent gas. The coke or residue may then be withdrawn from the retort, which, being allowed to cool down, below a visible red heat, (to prevent waste of the fresh material to be introduced) may be again charged with a quantity of coals to be treated in the like manner. The crude parafine oil distilled or driven off from the coals as a vapor, will be condensed into a liquid in passing through the cold worm-pipe, from which it will fall into a vessel which must be provided to receive it. Instead of obtaining the whole of the parafine oil by distillation, a portion of it may in some cases, if thought desirable, be run from the retort (through an opening and a pipe provided in the anterior and lower part of the retort for that purpose) after it has separated from the coal and assumed a liquid form. The patentee prefers, however, in

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every case to distil or drive off the whole of the parafine oil to be obtained from the coal. The production of the desired products from a charge of coals in a retort will be known to be finished by the liquid ceasing to run from the worm. The crude product of this process is an oil containing parafine, which the patentee calls parafine oil. This oil will sometimes, upon cooling to a temperature of about 40° Fahr., deposit parafine. Other arrangements of apparatus may be used for subjecting coals to the process for obtaining parafine oil therefrom, but that above-mentioned is preferred as being well known and easily managed. But in order to obtain the largest quantity of crude parafine oil from coals by means of this process, and produce the smallest quantity of permanent gas by the action of the heat employed, whatever may be the apparatus used, care must be taken to heat the coals gradually, and to apply the lowest temperature necessary to complete the operation. During the distillation or driving off, a permanent gas will be produced, and this gas may either be collected or suffered to escape as may be thought expedient. The crude oil obtained, as already described, is purified in the following manner:—I put the oil into a cistern, and heat it (by a steam pipe or other means) to a temperature of about 150° Fahr. When thus treated, water and undissolved impurities contained in the oil will separate more readily from it than when cold, and the oil being left in a state of rest and kept warm for about a day, many of those impurities will fall to the bottom of the cistern, and the oil may then be run off into another vessel, leaving the residuum behind. For distilling the oil the inventor prefers to use an iron still, with a worm-pipe connected to it, passing through a refrigeratory apparatus, which is kept at or about the temperature of 55° F., as already mentioned, The still is heated by a fire underneath it, which is kept up until the whole of the oil has been distilled over, and it will then be found that the still contains some dry carbonaceous residuum, which should be taken out before the still is again used. The oil is to be run from the condensing apparatus as it distils over into a leaden vessel, where to each 100 gallons there are gradually added 10 gallons of the oil of vitriol of commerce. After this mixture has been well stirred for about an hour, it is to remain at rest for about twelve hours, so that the oil of vitriol and the impurities with which it has combined may settle at the bottom. The supernatant oil is then drawn off into an iron vessel, and to four gallons of a solution of caustic soda, of a specific gravity 1·300 (water being 1·000), added to each 100 gallons. The soda and oil are stirred together for about an hour, so as to neutralise any acid which may remain in the oil, and also take up any impurities capable of combining with it, after which the contents of the vessel are allowed to remain at rest for about six or eight hours, so that the solution of soda may subside, and then the supernatant oil is to be drawn off, and again distilled in the same manner as already described. Parafine oil obtained from the last-mentioned distillation contains a fluid more volatile than parafine, a considerable portion of which may be separated from the oil and obtained in a separate state as follows:—The oil is placed in an iron still connected with a worm-pipe passing through a refrigeratory apparatus, and half its bulk of water being added, the contents of the still are boiled for about twelve hours, adding water from time to time, so as to keep about the same proportions of oil and water in the still.

The volatile fluid will pass over along with steam, and be condensed in the worm-pipe by the refrigeratory apparatus. This fluid will be clear and transparent, and as it is lighter than water, it separates, on standing, from the water with which it will be mixed as it leaves the worm-pipe of the still. The fluid may be burnt for the purpose of illumination, or applied to any other useful purpose to which it may be applicable. The last-named process will separate the greater portion of the volatile fluid from the oil, but a larger quantity may be separated by prolonging the operation. The oil left in the still after the completion of the process is then to be carefully separated from all the remaining water (upon which it will float) and conveyed into a leaden vessel, where two gallons of oil of vitriol are to be added to each 100 gallons. This mixture is to be well stirred for six or eight hours, after which it is allowed to stand undisturbed for twenty-four hours, in order that the vitriol may settle to the bottom of the leaden vessel, carrying with it all impurities with which it has combined. The supernatant oil is now to be drawn off into another vessel, and to each 100 gallons there is added 28 pounds of chalk ground up with a little water into a thin paste. The oil and chalk are to be well agitated until the oil becomes entirely freed from any trace of sulphurous acid, which may easily be known by heating a little of it in a glass retort, and testing its vapors by moistened blue litmus paper. If the vapors change the color of the litmus paper to red, the oil must be treated with more chalk. This oil is to be kept warm—

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say at 100° Fahr.—in any convenient vessel for about a week, to allow impurities to settle, and it is then fit to be used for lubricating purposes, either by itself or mixed with an animal or vegetable oil, or it may be burnt by itself in argand lamps for the purpose of illumination. To extract paraffine from the purified paraffine oil obtained in the manner described, the oil is to be cooled to a low temperature—say to 30° or 40° Fahr.; and the lower the temperature, the larger will be the quantity of paraffine separated from the oil. In this way paraffine is made to crystallise, when it may be separated from the oil by filtration through woollen or other cloths, and then squeezing it in a powerful press, by which means it will be made sufficiently pure to be employed for lubricating and some other useful purposes. But the paraffine may be further purified, if required, by treating it several times, at a temperature of about 160° Fahr., alternately with its own bulk of oil of vitriol and with a similar quantity of a solution of caustic soda (of the specific gravity already mentioned) until the paraffine ceases to render the oil of vitriol black. It is then to be washed in a weak solution of soda, and lastly with boiling water, until the water ceases to change the color of red litmus paper. Another method adopted to obtain paraffine from paraffine oil, is, to put the oil into a still, and distil over one half or more of its contents. The portion then remaining will contain a much larger proportion of paraffine than the paraffine oil at first put into the still contained; this residue being then distilled over into a separate vessel, and allowed to cool. Paraffine may be separated by filtration and squeezing in cloths, and also purified by treatment with oil of vitriol and soda as before described Paraffine oil from which paraffine has been separated, as above described, still contains paraffine in solution, and is suitable for lubricating or other lighting purposes.

Claim.—The obtaining of paraffine oil, or an oil containing paraffine, and paraffine from bituminous coals, by treating them in manner before described.

Improvements in lime and other kilns and furnaces. JOSEPH CHRISTIAN DAVIDSON, of Yalding, Kent, brickmaker. Patent dated November 2, 1850.

1. Mr. Davidson's improvements have relation to lime-kilns, in which, as usually constructed, the fire has been lighted in the kiln underneath an arch built of the limestone to be calcined. According to this method, a great waste ensues from pieces of the stone chipping off by the action of the heat and falling into the fire, from which they have necessarily to be removed. It is now proposed to have the fire-place alongside of the kiln, and to conduct the flame and products of combustion through the side of the kiln, to act upon the limestone, which is to be piled in the kiln on an arch built in the usual manner, and so as to act as a reticulated flue.

2. The same principle is applied to the kilns used for baking bricks, the fire-places being arranged at the side of the kiln, in such position as to make the openings in the walls thereof the throats of the furnaces.

Improvement in dyeing wool and other fibrous materials and fabrics. VICTOR EMILE WARMONT, of Neuilly-sur-Seine in the Republic of France. Patent dated November 2nd, 1850.

This invention is for improvements in dyeing wool and other fibrous materials in the skein, and in skein fabrics. The means by which the patentee carries his improvements into operation, consists of frames composed of a series of blades fixed together at determined distances, by means of rods, or other suitable fastenings. These blades may be made of hard wood or metal, or any other material that may be found adapted to the purpose; the patentee preferring to make them of fir. They have four surfaces, the width of which vary according to the extent of coloring required to be fixed; and the front surfaces are covered with cloth, felt, or other similar material. The material, or skein, previously moistened, is placed between two similar frames, upon the blades of which the coloring matter has been put; and the frames are so arranged that the blades of both may exactly coincide. The two frames with the skein between them, are then placed in the color-bath, into which it is necessary to place them to give them the desired tints. It will be evident that the coloring-matter of the bath will only be received by those portions of the skein or fabric which are not enclosed between the blades of the two frames; while the portions enclosed between the blades, will receive their color from the blades. The respective sizes of the blades, and of the spaces between them, will therefore entirely depend upon the amount of surface requiring to receive different colors. The frame may be left in the bath about half-an-hour more or less, according to the depth of color that is required.

One or more similar frames, containing materials which are to be similarly colored, may be placed in the bath at the same time. In order that the frames and the materials

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they contain may be subjected to the action of the bath in the most certain and perfect manner, the patentee prefers placing all these frames into another frame: the opposite side being bolted together so as to secure the frames and their materials in the steadiest position. When this series of frames, fastened together as just described, are taken out of the bath, they should be laid upon one face; and cold water should be thrown over the whole. When the skeins are washed and dried, they are wound in the usual manner; and if the yarn sticks together, the patentee proposes to carry on the winding under the action of steam.

By this method, shades of every description can be produced from fibrous materials.

No claims.

Improvements in preventing incrustation of steam and other boilers. BENJAMIN GUY BABINGTON, of George-street, Hanover-square, doctor of medicine. Patent dated November 7, 1850.

This invention consists in the application of voltaic agency for preventing incrustation in boilers by connecting to the interior of such boiler a plate of some metal more susceptible of oxidation than that of which the boilers are composed, and in such a position as to be wholly immersed when the water in the boiler is at the usual level.

The patentee recommends for iron boilers a plate of zinc of the ordinary description, and of a weight of 16 oz. to the square foot, which should be attached by one of its edges, by means of solder, to the interior of the boiler, and that the proportion which such plate should bear to the immersed surface of the boiler should be one-fifteenth, reckoning one side only of the zinc plate. Both sides of the plate being left exposed to the action of the iron and the water in the boiler, the voltaic agency thus excited is found to produce the desired effect. For large boilers two, three, or more plates are recommended, the relative proportions above stated between the surface of the plate and that of the immersed portion of the boiler being maintained.

When the zinc plates are corroded, as they will be found to do, though but slowly, they are to be removed and be replaced by others.

No claims.

Improvements in the preparation of cotton and other fabrics and fibrous materials. JOHN MERCER, of Oakenshaw, within Clayton-le-Moors, gentleman. Patent dated October 24, 1850.

This invention consists in subjecting vegetable fabrics and fibrous materials, cotton, silk, and other fibres in the raw or manufactured state to the action of caustic soda or caustic potassa, dilute sulphuric acid, and chloride of zinc, of a strength and temperature calculated to produce the results afterwards pointed out.

1. In applying this invention to the treatment of bleached cloth composed of cotton and other vegetable fibre, the cloth is passed through a padding machine charged with caustic soda or caustic potassa of a strength of 60° to 70° Twaddell, and at the common temperature (about 60° Fahr. or under); it is then washed without being dried, and immersed in dilute sulphuric acid, and again washed. Or it is run over and under rollers in a cistern, with caustic soda or caustic potassa of 40° to 50° Twaddell (at common temperatures); the last two of which are set so as to squeeze any excess of alkali back into the cistern. It is then passed over and under rollers in a series of cisterns filled with water, so that at the last cistern the cloth will be almost entirely free from alkali. After passing the cloth through the padding machine, or the cisterns above described, it is washed, soured with dilute sulphuric acid, and washed again, when it will be fit for use.

The same process, slightly varied, is also applied to the treatment of gray or unbleached cloth, of warps, of hanks of thread or yarn, and of the fibre previous to its manufacture.

The cloth, when thus treated, will be found to have shrunk, both in length and breadth, and to have become thicker; the effect produced being similar to that of the operation of fulling on woollen fabrics. It will have become stronger, each thread requiring greater force to break it. It will have acquired considerably increased capability of receiving and retaining colors, and it will be found to be much heavier, as may be proved by weighing it at the same temperature before and after the operation.

2. The patentee employs sulphuric acid diluted to about 105° Twaddell; and in this case the operation is performed in exactly the same manner as if caustic soda or potassa were employed, with the exception of the last souring process, which will be rendered unnecessary.

3. Chloride of zinc may be employed. This is used of a strength of 120° or 125°, and a temperature of about 160° Fahr.

In operating on fabrics composed of mixed vegetable and animal materials, it is preferred to use the alkaline solution of

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a strength of 30° or 40° Twaddell, and at a low temperature to prevent injury to the latter.

Claim.—The subjection of cotton, linen, or other vegetable fibrous material, either in the fibre or any stage of its manufacture, and either alone or mixed with silk, woollen or other animal fibrous material, to the action of caustic potassa or caustic soda, dilute sulphuric acid, or solution of chloride of zinc, of a strength and temperature sufficient to produce the new effects, and give them the new properties above described, either by padding, printing, or steeping, immersion, or any other method of application.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE GREAT EXHIBITION OF THE WORKS OF INDUSTRY OF ALL NATIONS.

THE 1st of May 1851 will ever be noted as one of the most glorious days in England's history. Of all the noble deeds which proudly adorn the annals of this country, the noblest was then accomplished. The contests of nations were removed from the bloody and fiendish battle-field to an arena of peace and welcome, where all is honorable strife, in which labor and skill are the weapons employed. The building in Hyde Park—well called the Crystal Palace—is at this moment the depository of the keenest exertions of human intellect, as developed under the varying conditions of country, clime, and race, to be found on the surface of this globe. From the first productions of the soil, to the investigations into the laws which govern the motions of the mysterious universe of which our planet forms but a minute speck, everything has there its illustration. It was befitting the grandeur and solemnity of the scene, that the opening of this contest should be witnessed by multitudes far more numerous than were ever collected for hostile strife, and should be led by one of the most powerful sovereigns, and certainly the most beloved in the world. It was befitting that the inauguration of such a scene should be commenced with loud Hallelujahs to the Almighty Giver of all the wondrous things there collected. And it was a spirit-stirring scene, which will remain deeply seated in the memories of all who were present, when, after the cessation of the glorious chorus which was raised by a thousand voices, the Queen of England, the Sovereign of her people's hearts, passed with a gorgeous procession along the magnificent nave, amidst the deep welcome of her subjects and her visitors, the loud and impressive pealing of organ after organ, and the flourish of trumpet, horn and drum.

It cannot be, but that harmony and peace must be extended throughout the world, when all nations combine as they have now done, to show to each other the extent of their powers, to offer for mutual benefit and instruction the knowledge which each possesses.

In passing from general impressions to those details which relate to our province, however, we may be permitted to remark that this Exhibition of the world's industry and knowledge must be exceedingly gratifying to chemists. There is scarcely a department that is not indebted to chemistry for its perfection and beauty. From the delicate colors on fine textile fabrics to the huge metallic foundings, the chemist has superintended some part of the process. In short some of the most marvellous productions to be found there are the direct result of the chemist's work. We shall from time to time point out some things relating to and illustrative of the contributions of chemistry to the production of the various articles exhibited, confining ourselves on the present occasion to a very brief notice

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of a few of the chemical and pharmaceutical substances exhibited.

On our first entrance into the magnificent edifice erected to contain the choicest productions of the world, we felt completely awed by its immenseness and beauty, and it was some time before we could bring our mind from the contemplation of the grand whole to a consideration of its minute details. When we stood in the splendid transept and beheld, for the first time, the enormous cruciform interior, occupied by exquisite statuary and other conspicuous objects, such as the elegant fountains, the colossal Bavarian lion, Mr. Ross's stupendous telescope, the large stone cross, the statue of Godfrey of Bouillon, the fine stained window by Bertini, the block of zinc weighing nearly 8 tons, we could scarcely have imagined that anything could so greatly have exceeded our highest anticipations.

The chemical and pharmaceutical departments (class 2) certainly in some measure disappointed us; for we had hoped that chemists would have come forward in greater numbers, and have exhibited a greater variety of products, and that those would have been *entirely* of their own production. We saw numerous specimens of yellow and red prussiate of potash, but not one good crystal; they are crystallised in various forms on wooden bases; and some of them are exhibited by persons who are not commonly known to manufacture this article. We cannot approve of such doings as this, and we think that every exhibitor should have been compelled to sign a declaration to the effect that he had produced (or bought, stating of whom) each article exhibited by him. These remarks apply with equal force to the sulphate of copper exhibited.

Although disappointed at the smallness of the number of exhibitors in this class, and at the very few specimens generally exhibited by each, we have to express our gratification at the beauty of many articles.

Not having had sufficient opportunity for examining all the chemical and pharmaceutical products of the United Kingdom, we must for this month content ourselves with a passing notice of a few, reserving a more detailed account and criticism for future articles.

Messrs. May and Baker, of Battersea, 14, exhibit camphor, in the refining glass, a fine specimen of refined camphor, and some excellent samples of mercurial preparation. We were much pleased with these.

Messrs. Hill of Deptford, 23, Refined nitre. A large sample of sal ammoniac, being the top of a subliming balloon.

Messrs. Winsor and Newton, Rathbone Place, 28. Artists Pigments, brushes, pencils, and canvas used by artists. These eminent manufacturers of artists' colors have really enhanced their already high reputation by this exhibition of their inimitable preparations.

Mr. Lloyd Bullock, Conduit Street, 34, exhibits some chemical substances used in food and medicine, and amongst the former his excellent preparation Semola, which has already earned the approbation of the medical world, and is an excellent scientific attempt to supply nitrogenous food to those who require nitrogen in greater quantity than ordinary diet will afford it.

Messrs. Huskisson, 86, have some exceedingly beautiful preparations, amongst which we may notice more particularly acetate of zinc, resublimed iodine, some iodide of potassium in fine crystals, and a very beautiful specimen of gallic acid.

Messrs. Blundell, Spence and Co., 48, exhibit colors for oil painting and paper staining, and white zinc paint, oils, varnishes, &c., all of excellent quality.

Mr. Lawrence, of Sloane Street, 56, exhibits some beautiful samples of cod-liver oil.

Mr. Lamplough, of Snow Hill, 71, exhibits some aloes, opium, myrrh, Russian castoreine, ipecacuanha, and rhubarb; he has also put forth what he calls pyretick

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salts, and some salts which he says were produced from burning human flesh; the pyretick salts prepared by Mr. Lamplough are intended to supply the system with such salts as he obtained by burning human flesh. We do not understand this portion of his exhibition very clearly, but so far as our comprehension goes, we feel inclined to regard this as a piece of thorough quackery, which should never have found a place in the exhibition, a remark which we may also apply to a sample of myrrhine, exhibited by Mr. Lea, of Oxford Street, 105, and which, he says, aids in the digestive process. Until these exhibitors satisfy us to the contrary, we shall regard these articles as quackery and trash.

Messrs. Savory and Moore, 115, exhibit kousso and Sumbul, two new and valuable medicines imported by them.

Mr. Jacob Bell, 116, exhibits cod-liver oil, stearine, sarsaparilla, juice of taraxacum, otto of roses, &c., and a large lump of salt from the Droitwich Patent Salt Works. We were not aware that Mr. Bell was a manufacturer of cod liver oil or stearine. He may be, but we did not know it. Not having seen any of his specimens, except the lump of salt, we can pass no opinion on them at present. As for the salt, we have often seen as good sold in the streets at 3 lb. for 1d.

In the philosophical department, class 10, we noticed some fine specimens of chemicals for daguerreoptye and calotype purposes, especially gallic and pyrogallic acids, hyposulphite of soda, large flakes of resublimed iodine; also apparatus for the same purposes, of excellent construction, and other philosophical instruments, exhibited by Messrs. Horne, Hornethwaite and Wood.

Messrs. Knight and Sons also exhibit chemicals and apparatus for the same purposes, which fully maintain the high character of the exhibitors.

Messrs. Griffin and Co. have an excellent assortment of apparatus for chemical purposes.

Mr. W. T. Henley, of St. John Street Road, Clerkenwell, exhibits a large permanent horse shoe magnet, weighing 6 cwt. weight and capable of sustaining a weight of from 2,000 to 3,000 pounds—a magneto-electric machine arranged for intensity patent electric telegraphs worked by the magneto-electric current. These instruments are exceedingly well constructed and highly finished.

Messrs. Watkins and Hill, of Charing Cross, exhibit a powerful electro-magnet and other philosophical apparatus of first-rate construction.

In concluding this very brief and hurried notice, we have only to observe that it would have been much more complete had the Executive Committee sent tickets earlier. It appears to us that we and all others of the scientific press should be admitted at all times during the season for purposes connected with our publications, free of expense, a privilege granted to the Newspapers, few of which have the slightest scientific tendency, and of whose editors few are capable of forming an opinion on chemical and philosophical subjects.

We should not complain, had free admission been granted to none of the press; but while the representatives of newspapers have this privilege, we cannot but consider ourselves improperly denied the same advantage. It is with us a matter of principle. As caterers for the public, every facility should be afforded to us. Lectures are to be delivered in the Building, by eminent professors. Why should not we be encouraged to give our numerous readers information concerning the way in which chemistry has aided in the production of so many of the articles exhibited? Such illiberality is not worthy of those who are carrying out so grand a scheme, and who have in other respects so ably fulfilled their duties. There is much work for us to do at this exhibition, and we shall doubtless have much to say about it, which we hope will be useful and interesting to those of our country readers who may be unable to visit the Exhibition.

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ON THE PREPARATION OF MEDICINAL WINES.*

BY M. DESCHAMPS, OF AVALLON.

MEDICINAL wines being very frequently employed for facilitating the administration of agents intended to modify the derangements manifested in our vital functions, I have thought that it would not be useless to study them afresh, and to ascertain whether the reproach of preparing these wines badly, which is cast upon pharmaceutists by some pharmacologists, is or is not well founded, and whether pharmaceutists who merely follow published processes might not with greater reason reproach those pharmacologists with having bad formulæ, since, of all pharmaceutical operations the preparation of medicinal wines is indisputably the simplest and most easily executed.

In studying the numerous formulæ of medicinal wines which have been published, we find:—

1. That pharmacologists do not agree as to the nature of the wine which should be employed in preparing them; that some recommend white and red wines indiscriminately, that many think that it is preferable to select white wines; that others think that red wines should be preferred because they can be kept longer than white wines; that according to others white wines should in some cases be used, and red in others, in order to turn to account, when required, the coloring matter and tannin which these wines contain; that others think that wines of the South, to which alcohol has been added, are alone proper for use; and, finally, that others are persuaded that it is preferable to employ Malaga, Madeira; &c., &c.

2. That these recommendations are not supported by observations or reasoning capable of convincing everyone; that it is not matter of surprise, consequently, that we find in the shops the same medicinal wines prepared sometimes with white and sometimes with red wines, since pharmaceutists are in the habit of selecting their wines according to the confidence they feel in such a pharmacologist; and that pharmaceutists cannot be accused of preparing these wines badly, since, hitherto, their formulæ have been given in such a manner that each pharmaceutist may consider them accurately prepared, for most pharmacologists content themselves with prescribing the selection of Gureran, Burgundy, or Bordeaux, &c., knowing, however, that in designating the wines which must be employed, by the expression *generous wines*, they rely on a qualification which is incapable of characterising them, since wines may be generous or of good quality in one wine country, and of very mediocre quality in another.

3. That among the pharmacologists who studied the preparation of these wines, many advise the addition of alcohol to those intended for this purpose: that very few recommend the addition of alcohol and sugar in order that they may substitute foreign wines; that those who prescribe this addition do not employ alcohol of the same degree; that many give no recommendation at all; and that none pay any attention to the amount of alcohol contained in the wines which they prescribe.

4. That the wines of the South are not better suited for the preparation of medicinal wines than the wines of other parts of France, because the quality of these wines is like that of all wines, dependent upon the nature of the soil, the aspect, the kind of vine cultivated, the maturity of the grape, the atmosphere at the time of gathering, the mode of preparing the wine, the care bestowed on mixing the wine in the vat, the pressing, &c., &c., &c., and because if it is necessary to add alcohol to the wines of the South, it is easy to do the same to all wines, and to render them as suitable for the preparation of medicinal wines as the wines of the South and even as foreign wines.

5. That the preference given to Malaga and Madeira wines, &c. is easily understood when it is desired to administer them alone, for their taste and odor are very agreeable and pleasing to invalids; that this preference cannot be advantageously maintained when these wines are intended for the preparation of medicinal wines, since their taste is changed, and we rely more on the therapeutical agent dissolved in the wine than on the wine itself, since it is intended really to prepare a reagent capable of curing many affections which would be in no way affected by the Malaga or Madeira wines, &c., since it is very difficult to obtain these wines genuine, and since there is no reason for preferring adulterated wines which have received the names of Malaga, Madeira, &c. to natural wines.

6. And, finally, that white wines should be preferred to red wines because their preparation is much more simple and much more easy of execution than that of red wines; because they are made everywhere in the same manner, because they resemble each other more than red wines do; because a medicinal wine prepared with red wine

* *Journal de Pharmacie*, May, 1851.

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often resembles, after a very short time, sometimes as soon as the maceration is finished, that which would have been prepared with white wine; because this alteration could not take place in so short a time, only because an insoluble combination is formed with the tannin, the coloring matter and some principles of the medicinal substances, and, as M. Soubeiran found in studying, with the ability characteristic of him, the preparation of the wine of quinquina, because the coloring matter of red wines is deposited on the ligneous fibre like tinctorial substances, the tartar acting as a mordant.

From the foregoing considerations, it is easy to perceive that medicinal wines cannot be prepared in the same manner in all pharmaceutical establishments, since pharmacologists do not accurately point out the quality of the wines which should be selected; and it is very important to find a method which will enable pharmaceutists to prepare these wines in an uniform manner.

After having for a long time sought for the solution of this problem, I have come to the conclusion that the preparation of medicinal wines would be much improved if, instead of recommending pharmaceutists to employ generous Burgundy or Bordeaux wine, &c., they were permitted to employ the wine at their disposal, for it appears to me more rational to leave them at liberty to employ the wines of their locality, or which they can buy in the country they inhabit, provided that they be genuine, than to compel them to procure from a distance wines which are almost always mixed, or which in most cases do not present any advantages over their local wines, since it is sufficient, to be able to employ all wines for the preparation of medicinal wines, to determine their alcoholic strength and to alcoholise them, taking account of the alcohol they contain naturally so that they may always contain the same quantity, and to add sugar in order that they may retain longer in solution the principles which they may have extracted from the medicinal substances, to fix a certain quantity of alcohol which should never be exceeded, and to calculate for each wine the quantity of alcohol necessary to be added.

In order to save pharmaceutists the trouble of making these calculations, I have constructed a table by means of which the quantity of alcohol &c. to be added to any wine may readily be found.

TOPICAL EMPLOYMENT OF BINIODIDE OF MERCURY IN LUPUS.*

BY M. CAZENAVE.

After several fruitless endeavors, M. Cazenave had recourse to bin-iodide of mercury in very large doses. This attempt was crowned with a success which experience has not since contradicted.

Under the influence of bin-iodide of mercury, often repeated a great many times, after the local inflammation active although transient, caused by this agent, the hypertrophied points disgorged, the tubercles sunk down, and disappeared, and soft, superficial scars, even with the remainder of the skin were formed: in fact, the most repulsive lupus became cured, leaving no traces excepting a thin skin with here and there white or red spots, according to the age of the scars.

Amongst a great number of facts already mentioned, M. Cazenave mentions two which clearly shew the efficacy of this new agent.

In the first, he mentions a scrofulous lupus with hypertrophy, which had been treated for six months with iodide of potassium, chlorides of barium and calcium, and Pearson's solution, all without success. Cauterisations with bin-iodide of mercury were tried; the first produced so sensible an improvement that a complete cure was expected. In fact, forty cauterisations in the space of thirty months brought about this cure; it must be added that the patient took a vapor bath every second day, and was for some months subjected to a course of cod liver oil.

The second case differs from the first, chiefly inasmuch as fifteen cauterisations in a year sufficed for the cure.

In general, the application is not immediately painful; but it is soon followed by such keen pain as to draw complaints and even cries from the patients. This is felt first in about ten minutes, in half an hour it most frequently attains its height; and it lasts thus for a longer or shorter time according to the extent of the part touched, the dose of biniodide, and the sensitiveness of the patient. The average is from eight to ten hours. The pain is soon followed by a swelling which is slower both in its appearance and departure. Thus, twenty-four hours after the topical application, not only are the parts touched, red and tumefied, but an erysipelatous inflammation occupies the adjacent surface, without however extend-

* *Annales des Maladies de la Peau.*

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ing very far. If, for example, the biniodide is applied to a portion of the nose, the upper part of the corresponding cheek and the eye on the same side will be the seat of a sort of erysipelas, with considerable swelling; but the erysipelas seldom occupies the whole face. Under all circumstances it begins to diminish at the end of eight and forty hours, and by the third or fourth day it disappears. Finally, round the layer of biniodide there is from the first a fluxion, followed by exudation, of a plastic character, which occurs first round the spot, but which in the end penetrates it and forms with it a soft crust which dries gradually more and more. In the midst of this crust, the biniodide shines for several days, exhibiting points of a brilliant red; but these soon gradually disappear, leaving a dry crust, of a blackish grey color, of a crystalline appearance, generally adhering very slighty. It detaches itself after 6, 8, or 10 days, and leaves afterwards a tubercle which has half disappeared, a smooth surface, less swelled, sometimes dry, in fact, an even, slight, cicatrix, on a level with the rest of the skin.

When the biniodide has been applied to denuded surfaces, the same thing takes place; only the pain is more violent, the fluxion more prompt, and the crust thicker and more adherent. When the crust falls off, the edges of the ulcer are cleared, the lips of the wound thinner, the vegetations are considerably sunk, or else the bottom is covered with red, fleshy pimples, of good appearance; a great tendency to cicatrisation is perceived; finally, the obstruction of the neighbouring ganglions is diminished.

Besides this local action, M. Cazenave has recognised in the biniodide of mercury a general action, manifested by a sensation of feebleness and lassitude.

The biniodide of mercury may be dissolved in ether, incorporated in lard, or suspended and mixed in oil. The mixture with lard is preferable to the solution in ether, because it allows of a much higher dose. However, when made beyond the proportion of 3 or 4 grammes to 30 grammes of lard, the mixture rapidly becomes hard, and consequently unmanageable. M. C. has therefore employed it almost exclusively suspended in oil, and he has been able to suspend equal parts; here, however, another, inconvenience had to be contended with; on being left to repose, the oily quickly separated, and when it was again required for use, the matter at the bottom had become so hard, that it was impossible to remix it. This inconvenience is remedied by adding one part of lard, which forms with the mixture a kind of liquid paste. It is applied with a hair pencil, by means of which a thin layer is deposited on the places which require it. As this application may very frequently be repeated, every six or eight days, and as it is always very painful, it is better, in general, to apply it only to small surfaces at a time.

On the whole, says the author, I now regard the biniodide of mercury in large doses as the best topic to be applied in cases of lupus. It is one of the surest modes of treatment, not only for obtaining the cicatrisation of ulcerated surfaces, but also for curing without wound and by means of superficial cicatrices, tuberculous lupus, (*erythème centrifuge* of Biett.)

ON THE USE OF COD-LIVER OIL IN THE TREATMENT OF PHTHISIS.*

BY DR. LEWICK.

EXAGGERATED impressions of the value of cod-liver oil have no doubt been made, to be followed by their necessary disappointments. All the results promised by some writers from it have certainly not followed its use in the hospital, nor in a large number of cases in private practice, which, through the kindness of his medical friends, the writer has had an opportunity of closely watching. On the other hand, we can positively say, that most of our patients, while using the oil, have increased in flesh, in weight, and in strength; that with most of them there has been a diminution of cough and of expectoration; that with some of them hectic and rigors have entirely disappeared; and that there have been some so benefited as to be able to resume their former occupations. We can also understand that it may so strengthen the patient as to enable him to make use of those hygienic means which are so efficacious; that it may thus, perhaps, indirectly cure consumption. Again, in phthisis, as the local affection is but a part of the disease, if the general health continue to improve, we may hope the diathesis, will be, in the course of time, thoroughly changed, and thus, perhaps, cod-liver oil may cure consumption. But these suppositions are merely such; the assertion of its good, but limited, effects, are positive. The first may happen, the last have happened.

* *American Journal of Medical Science.*

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An objection has recently been made to the use of cod-liver oil that it produces pulmonary congestion and hemmorrhage. This is a plausible suggestion; we have not found it to exist in practice. The only instance in which an attack of bleeding could be positively traced to the use of the oil, was, that of a patient admitted for hæmoptysis, who, after having been in the house for several weeks, with great improvement of his hemmorrhagic symptoms, was placed on the use of the oil from some suspicious physical signs. Nausea and emesis were produced by the oil, and hemorrhage followed the act of vomiting. This may suggest a caution under similar circumstances.

In no instance did any decided benefit arise from the oil until it had been used for at least *four weeks;* it is equally important to observe, that, to be of any permanent benefit, its use must be persisted in for a long time, even after the most striking symptoms of the disease have in a great measure disappeared; a fact of which we have always endeavored to impress the importance on our patients at the time of their dismissal from the hospital.

Although, then, our experience has not been quite so gratifying as has that of some others, yet the writer is fully prepared to say that he believes cod-liver oil to be by far the best remedy for phthisis pulmonalis of which we have at this time any knowledge; and that to neglect its use in cases of this disease, unless there be a strong contra-indication, is, under existing circumstances, both injudicious and culpable.

SOLUBLE IODIDE OF STARCH.*

BY M. DRUN-BUISSON, OF VOIRON.

Soluble iodide of starch, very recently employed in medicine, is destined to become, in therapeutics, a valuable remedy, in consequence of the double advantage to the physician of possessing a product which will constantly contain the same proportion of iodine, and will be easy of administration, above all to young patients who have so much repugnance to taking cod or skate-liver oil; but I do not consider, with the author who first conceived the happy idea of rendering iodide of starch soluble, that it will replace them, because the cod and skate liver oils act not only by the presence of iodine in their composition, but likewise by the combustion of a peculiar fatty matter during the work of digestion. Still, to a certain extent, we may arrive at the same result by administering iodide of starch, by accompanying its use by a fatty and very animalised diet in order to give to the blood the degree of vitality necessary to rouse the organs.

It was the duty of the pharmaceutist to aid in seeking a process which should in no respect give place to the result obtained by Dr. Quesneville. This secret, I may term it, having been hitherto the subject of a special right in a particular province, was the effect of some researches undertaken by M. Magnes-Lahens, which have been published in the *Journal de Médecine* of Toulouse. This process, which succeeded in his hands, and which I have frequently repeated, has never given me satisfactory results.

I request you, Mr. Editor, adding my name to the numerous fellow-laborers who, like myself, have tried processes perhaps more worthy of figuring in your collection, to insert in your next number the method of operating which I have adopted after many laborious researches and unfruitful attempts.

I triturated one part of iodine for some short time in a mortar, and added by degrees nine parts of starch, I placed the whole, when intimately mixed, in a small cast iron pot enamelled inside, of which the cover was perfectly luted down and confined by an iron wire, a precaution necessary to avoid an explosion at the moment when the starch loses its moisture. I place the entire apparatus into a half-incinerated brazier, and I remove it at the end of half an hour. On opening it, after cooling, I found the product increased to twice the volume, of a beautiful velvety black blue. The inside of the pot was covered with a thin carbonised layer, which I rejected; the product, washed in rectified alcohol to remove any uncombined iodine, and dried in the open air, was enclosed in a phial for use.

To prepare the syrup of soluble iodide of starch I used the following *modus faciendi*, which appeared to me preferable. I triturated 13 grammes of soluble iodide of starch with 30 grammes of distilled water; I added the mucilaginous solution to 500 grammes of gum syrup, which I adopted in preference to unclarified sugar, which tends to transform the iodine into hydroiodic acid, and consequently causes it to lose a portion of its beautiful blue color. The mixture, introduced into a stoppered bottle, was exposed for about an hour to a heat of about 180° F., in a sand-bath; I took the precaution of agitating it from time to time. After cooling, it should be kept from the

* *Repertoire de Pharmacie*, May, 1851.

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light. It is easy to understand that the whole secret of the process consists in combining the iodine with the starch, the cellules being broken, and especially in causing this phenomenon.

This observation leads me to speak of another process which has succeeded very well with me; it consists in making hydrate of starch in the same manner as ironers', dried and finely pulverised. I triturated iodine and starch as before, the mixture was introduced into a medicine phial and exposd to the heat of boiling water or of a sand bath for an hour, removed and cooled; I washed it with alcohol. The product is of an equally fine blue, but less velvety and less soluble than the preceding.

I have little difficulty in believing that in the end iodide of dextrine will be exclusively used for the same purpose, as its preparation is extremely easy; a product which is distinguishable by its deep wine color, and which is perfectly soluble.

ON CEDRON.*

BY M. LEWY.

In the hottest parts of New Granada, in Las Tierras Calientes, is found a tree which attains a great size, and which, in that country is called *Cedron, (Simaba Cedron, Planchon).* The fruit of this tree is a species of seed, somewhat similar in appearance to Saint Ignatius bean. Like that substance, it is distinguished by an extraordinary bitterness. The natives attribute to it a great efficacy against the bites of serpents, and in the treatment of hydrophobia and intermittent fevers. They administer it in doses of 5 centigrammes, and in the form of powder mixed with brandy. In large doses this seed acts as a violent poison.

I wished to ascertain whether the therapeutic properties of the fruit of the cedron should not be attributed to a well-defined substance which might be isolated and substituted for the seed itself in medicine. I succeeded in removing two bodies which appear to me very distinct, and which are easily procured by subjecting the pulverised fruit to successive treatment with ether and alcohol.

The etherial extract is a fatty matter, neutral, crystalline, almost insoluble in cold alcohol.

The residue, exhausted by ether, gives up to alcohol a substance which I have obtained in the crystallised state, and which I regard as the active principle of the cedron. Almost insoluble in cold water, this matter, which I shall call *cedrine*, dissolves very well in boiling water and alcohol, and crystallises from its solutions in silky needles. It is neutral to litmus paper. Its flavor is of a bitter comparable to that of strychnine, and even more lasting. Hitherto I have not tried to combine cedrine with the acids, so that I do not know whether it possesses well-defined alkaline properties.

M. Dumas adds that a traveller recently arrived in France, M. Saillard, Junior, of Besançon, has brought a very considerable quantity of cedron, which would serve for chemical or therapeutical experiments, should the Academy think proper to order their execution.

* *Répertoire de Pharmacie*, May, 1851.

ANTISEPTIC PROPERTY OF CHLOROFORM.*

BY DR. ANGEND, OF CONSTANTINOPLE.

If we take three wide-mouthed bottles, and pour into the first a small quantity of ether, the second a little chloroform, and leave the third as it is; and if we place in each of them a small piece of beef, hermetically seal them and leave them alone during the summer, we observe that the beef immediately becomes colored red brown in its natural state, and becomes at once of a vermillion red in the vapor of chloroform mixed with air in the second flask, whilst the ether produces no change in its appearance.

So much for the immediate effect. But after a week of contact, the results are much more decided.

The flesh kept in the air has scarcely changed in color; that in the vapor of ether has turned brown, whilst that preserved in the chloroform has aequired the tint of boiled meat.

On opening the flasks we observe that the flesh placed in the bottle by itself is putrid, and exhales a horrible odor; that the same has taken place with that kept in the ether; but that no change has occurred in that treated with chloroform beyond the sweet taste and odor belonging to the chloroform.

Chloroform has presented to Dr. Augend interesting properties as an antiseptic. He has proved, indeed, that $\frac{1}{200}$ of chloroform is sufficient for completely preventing the decomposition of a mass of fresh muscular flesh. The facility with which the vapor

* *Journal de Chimie Médicale*, May 1851.

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of this substance penetrates the thickest tissues, is no less remarkable. Chloroform has the advantage over creosote of not coagulating the albumen; neither is it decomposed by muscular flesh.

The most apparent action of chloroform, not only on the muscular flesh, but on the fleshy pericarp of seeds and fruits, is an immediate contraction of the fibre or parenchyma, which makes the aqueous juices flow to to the bottom of the vessel in which the operation is performed.

Dr. Augend is of opinion that this property of chloroform may be turned to account by naturalists, anatomists and those engaged in medico-legal investigations, for the preservation of objects.

ON THE UTILITY AND POSSIBILITY OF COVERING PILLS WITH A COATING OF SUGAR.*

BY M. MONTHUS, OF TOULOUSE.

PILLS, as every one knows, are medicaments which have been invented to facilitate to patients the taking of certain remedies which create disgust, and whose flavor is insupportable.

It was at first thought sufficient to roll the pills in liquorice powder, but by degrees, the pharmaceutist, whether giving way to the ideas of luxury which have attained their limit, or to the desire of the patient, has taken to the habit of enveloping them in silver leaf. Almost all pharmaceutists now silver their pills, and but few suffer any pills to leave their shop uncovered by their precious envelope.

The inconveniences attached to this method are considerable. In the first place, a well silvered pill, especially after some days, adheres so firmly to its envelope, that it requires often a long time before the pill is exposed to the action of the digestive juices; thus it happens that they sometimes produce but little effect in certain subjects in whose stomachs they become only partially dissolved. In others they occasion colic and irritation, sometimes in the stomach, sometimes in the intestines; it even happens sometimes that patients void them whole, and consequently without their having produced any effect.

Of late, M. Mothes devised a gelatinous capsule which justly merited universal approbation.

At the expiration of his patent the druggists made a sort of empty capsules, into which the pharmaceutist had only to insert the medicinal substance. This method never succeeded with me; and I do not think that any one was adept at it.

The envelope which attracts my attention, which generally pleases all the world, and the preparation of which I have brought to the greatest simplicity is the saccharine envelope.

The officinal pills may be very certainly, and very easily covered with a sugar envelope. It is not so easily to prepare magistral pills in this manner. The following is the process which I recommend:—

The pills are exposed to the heat of an oven, or of the open air, until the exterior portion is a little solidified. Then take:

	Grs.
Gum arabic	4
Simple syrup	10

The syrup and gum are to be quickly mixed, the pills are placed in a flat plate, the gummy syrup is poured on, they are well stirred, the pills are then dropped on a sheet of tin covered with a thick layer of finely powdered sugar, which is to be turned in every direction. At this period of the operation they seem rather large; but with time, the humidity evaporates, the sugar becomes concentrated, and they appear of only a very ordinary size.

Pills of prepared turpentine, when kept for a long time under water, become at the end of a certain time, a compact mass. If they do not stick together, they at least, become deformed, then the water which covers them spoils, dissolves them and removes all the essence.

The turpentine pills which I made six months ago have not suffered the least alteration; this has decided me to propose the process which I have just described.

* *Journal de Médicine de Toulouse.*

ON ERGOT OF RYE AND ITS FIXED OIL.*

BY DR. BERTRAND.

THE fixed oil obtained by means of ether from ergot of rye is, in general, of the same nature as other fixed oils. It is colorless, or nearly so; its taste is sweet and not acid. Some practitioners attribute to it the whole of the therapeutical virtue of the ergot, or at least a powerful narcotic effect, whilst Dr. Bertrand, who has experimented on himself with this substance asserts, that he has found no medical effect from it. He took 15 grammes of this oil, made into an emulsion with mucilage of gum arabic, after

* *Journal de Chimie Médicale*, May, 1851.

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having given from 2 drachms to one ounce at a time, to dogs, cats, and rabbits, he found no other effect than loss of appetite for a few days. Not the slightest symptom of narcotic poisoning was manifested.

If this is correct, ergot of rye deprived of its fixed oil by means of ether, ought to retain all its medicinal virtue, and the same weight should be more active. This, indeed, the author takes care to announce, and he adds that ergot of rye, freed from its oil by ether, has for a long time been employed by Dr. Kilian of Bonn, with the greatest success.

CASE OF PRESUMED POISONING BY ABORTIVES.*

BY SIGNORE GIOVANNI RUSPINI, OF BERGAMO.

THIS distinguished Italian chemist has just sent us a very interesting Memoir on a case of presumed poisoning which, having been committed to his examination, afforded him a proof of the insufficiency of our analytical means for detecting and characterising in the organism the presence of certain poisons of organic origin. It was required to ascertain whether a lady, who had been delivered of a child several months after having separated from her husband, and who had died suddenly three days after her accouchement, had made use of abortive agents during her pregnancy, and thus caused her death. Signor Ruspini, assisted by Signor Cogrossi, a pharmaceutist of the city, and at the request of the authorities, proceeded to the examination of the viscera of the lady, which, according to custom, had been carefully sealed up to prevent the possibility of alteration or substitution. The organic substance which had to be examined, and which still retained its organic structure, was separated by filtration into two parts, the liquid and the solid. We will not stop to examine this portion of Sig. Ruspini's memoir, the object of which is to make known the process followed by the operators for the detection of mineral poisons. The processes employed in these cases are too well known to those who devote themselves to such investigations to require description. Suffice it, therefore, to say, that no poison of mineral origin could be detected in either the solids or liquids tested.

With regard to organic poisons, Signori Ruspini and Cogrossi, having perceived that the liquids became rose colored by the addition of nitric acid, or sulphuric acid containing a certain quantity of nitric acid, had suspected the existence of morphia in the matters submitted to examination. It is true that this character alone would have equally demonstrated the existence of narcotine, strychnine, &c.; but if these chemists attended rather to the search for morphia, it was on account of a collection of characters which seemed to belong only to this alkaloïd. The characteristics of morphia being to acquire a red color with concentrated acetic acid, and a yellow color with the same acid diluted, and paler in proportion to the dilution, to give a blue tint with sesquichloride of iron, disappearing on the addition of an acid, and reappearing on adding an alkali; becoming crimson with iodic acid, (according to Serullas and Liebig the most certain test) and afterwards giving up the iodine to starch, forming the iodide of starch, turning blue with chloride of gold; finally, its bitter taste when existing in water in the proportion of not less than 0·00174: all these tests were employed to prove the presence of the suspected poison. The tests with nitric and iodic acids seemed to indicate the presence of morphia; the chloride of gold gave some traces of action, but ill characterised; the sesquichloride of iron gave no reaction, perhaps on account of the presence of animal matters, for a solution of animal gelatine, added to a solution of morphia, prevented the latter from being colored by a salt of iron. They then endeavored to extract the presumed alkaloïd from the substances containing it; but all efforts were vain, and iodic acid alone continued to furnish indications of the presence of morphia. A certain quantity of the liquids obtained in the operations used for extracting the poison was administered to a rabbit; the rabbit continued as well as if it had not taken it, whilst four grains of acetate of morphia, in distilled water, considerably increased the number of beats of the heart, and temporarily paralysed the posterior limbs. All these experiments therefore led to only a very doubtful result, the iodic acid alone indicating the presence of morphia. They then determined, notwithstanding the opinion of Serullas, Liebig, Lassaigne, and others, to submit this reagent to a decisive proof. They boiled the intestines of a calf in distilled water, filtered the solution, and having treated it with iodic acid and starch, obtained the characteristic and essential reaction of all the salts of morphia. Iodic acid is not, therefore, a certain test for this alkaloïd. They then endeavored to detect, in the matters analysed, the existence of ergotine or resin of ergot of rye; none was

* *Journal de Chimie Médicale*, May, 1851

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detected, but the most remarkable part of this investigation is, that ergotine, mixed with morphia, removes from the latter the property of being colored by the addition of chloride of gold. As we had had a negative result as regards morphia in the treatment of the matters analysed with the salt of gold, it was suspected that this might be owing to the presence of ergotine in the substances treated by this reagent.

Nevertheless, the whole of the reactions put together, and especially the remarkable circumstance of the morphinic coloration of the liquid extracted from the calf's stomach, did not enable Signori Ruspini and Cogrossi to conclude that there had been any poisoning in the case submitted to their examination. It seems to us also that the result of these researches should more than ever lead chemists to give their decisions only after mature deliberation on a question of legal chemistry so obscure and so imperfectly studied as the search in the organism after death for poisons of organic origin; and that especial care must be taken not to allow themselves to place too much confidence in the assertions of other experimenters, seeing that contradictory experiments frequently have not been tried by those who extol certain processes, and that it would be culpable in a chemist called upon to pronounce a judgment in such a matter not to verify all the characters on which he may rest his conclusions.

POISONING BY ARSENIOUS ACID.*

BY DR. W. R. RYAN.

DR. RYAN related a case of poisoning by arsenious acid, in which the symptoms were long in showing themselves. After citing the opinions of medical jurists, that symptoms of poisoning were seldom delayed beyond an hour, he quoted several cases where they continued five, and one or two where they were delayed to eight and ten hours respectively, the latter being "the maximum yet known." He quoted authorities to show the variable period of death, Dr. Taylor's opinion being given, that twenty-four hours was the average period. Dr. Ryan then narrated the case of Wm. H. H——, aged thirty-five, to whom he was called about one o'clock on Wednesday, July 14, 1847, and who had taken poison. He found him in bed on his back, vomiting frequently; he was quite collected. The patient appeared an intelligent man, and said that some time previously two men, in presence of a woman, used a term of obloquy towards him. After this he imagined people's eyes were suspiciously fixed upon him wherever he went. This was a delusion. He said that on the previous day, at two o'clock, P.M., he had taken half an ounce of arsenic in porter, adding water to take up what remained, and that he did not begin to vomit until eleven o'clock. His brother gave evidence to this effect at the inquest, as well as to the fact of his having rinsed out the pewter vessel from which the arsenious acid had been taken, and noticing a very small quantity of white sediment, of the nature of which he had no suspicion. That half an ounce was the quantity, was ascertained from the persons who served the arsenic. The patient also said, to which his brother afterwards deposed, that after thus vomiting at eleven o'clock, he did not get out of bed again until half-past seven o'clock next morning. He did not even then complain of suffering from poison. The brother, on his return at twelve o'clock, was for the first time informed of the fact of poison having been taken. The extremities were cold; no pulse at the wrist; slightly perceptible higher up; no pulse in dorsalis pedis, nor in posterior tibial, behind the inner ankle. He frequently raised himself on his elbow to vomit, and then fell back exhausted. The thirst was intense, and he took much drink during the morning; sensation of burning pain down the œsophagus; severe pain across epigastric region; more acute over region of liver; much increased on pressure; pain over abdomen; he was restless, and tossed about, ejaculating frequently; no inflammatory appearance about mouth or fauces. The basinful vomited during the morning and previous night had already been thrown away, and two basins were beside the bed, one containing the second quantity vomited—four quarts of a yellow, the other about three quarts of a very dark-green fluid. Hydrated peroxide of iron, sulphate of zinc, and the stomach-pump were put in requisition; friction to extremities, oleaginous aperients, subsequently opium, ether, and compound spirit of ammonia. Here were many of the symptoms of poisoning, yet the history of the case and the time symptoms were delayed, were calculated to raise a doubt whether arsenic had been taken. The fluids were therefore taken away for the purpose of analysis. The first basinful vomited having been thrown away, the second and third remained, and it is most important to remark, that from the third

* *Medical Society of London Meeting of April 5.*

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basin, in which were the contents of the stomach drawn by the stomach-pump, the arsenic was not only much more quickly detected, but from the very sediment in that basin (arsenic of iron, it may be presumed, as well as uncombined arsenious acid) being dried, and mixed with black flux, a ring of metallic arsenic was obtained by heat, thus showing that the poison had remained undissolved twenty-four hours, adhering most probably to the mucous coat of the stomach, was brought away undissolved, and so remained in the liquid. All the usual tests were tried with the usual results. By the coroner's orders, in case the poison were known, the body was not to be opened. On the Saturday following an inquest was held. During the first visit, the patient wandered a little; from first to last no attempt to rally. On the Thursday night the symptoms increased to intensity: he passed dark bloody stools, of a very offensive character. At ten on the Friday, the pulse scarcely perceptible, high up; the patient, restless, suffering from internal burning pain, and spasms of the extremities, went on until twelve o'clock, when he died convulsed; thus living within two hours of three days after taking the poison. Some time ago, had arsenic been administered criminally, in such a case as this, the proofs being slight, the party might have escaped, under the idea that symptoms could not have been so long delayed. This case will prove that symptoms may be long delayed, and may serve as a guide in future cases of criminal poisoning. Here is a man taking half an ounce of arsenic at two o'clock, July the 13th; he does not vomit until eleven at night, the act even then being attributed by his family to a tippling sickness. His brother deposes that he did not get out of bed until half-past seven next morning, and did not even then complain of suffering from poison; nor did he do so while his brother took breakfast—a period of nineteen hours, and with such a dose! We observed that he survived nearly three days, as well as the fact of a week's tippling, so completely enervating, narcotizing the stomach, as to incapacitate it from its usual healthy action, and in its deranged state allowing the common effects of the poison to be delayed. The fact is also seen, that there was more poison in the *third* basinful vomited,—washed away, as it were, and dislodged by the stream from the stomach-pump,—than in the other two. It is also observable how long he concealed his sufferings—a period of twenty-two hours.

Mr. Robert Wade had seen the patient whose case had been just related the second night after he had taken the poison. The symptoms were entirely those of collapse, and were not at all referrible to inflammatory action.

POISONOUS EFFECTS OF PEACH-KERNELS.*

BY DR. KEATING.

Dr. K. states that he was sent for in great haste to visit a little girl, aged three years, who had come in from playing with an elder brother, and suddenly placing her hand on her head, fell on the floor perfectly senseless.

When I saw the child, she was lying on the bed insensible; respiration slow, deep, and sobbing; no convulsion of the limbs, but a faint, flickering motion was observable about the muscles of the lips; hands and feet were icy cold; eyes prominent, pupils dilated; pulse slow and feeble; finger nails of a livid color and the hands slightly clenched. My inquiries elicited nothing from the mother which could account for the extraordinary condition of the child. Despairing of obtaining any clue to the case, and as a dernier resort, I applied my face to the child's mouth, and immediately recognised in her breath a strong odor of prussic acid. The idea of peach-kernels immediately suggested itself to my mind; and, upon interrogating her brother, I found that, previous to her coming into the house, she had managed to snatch from him a large quantity of peach-kernels, which he had been preparing for his mother's use. He also informed me that he saw her put a large quantity in her mouth at a time. Convinced, then, that I had to deal with a case of poisoning by prussic acid, I immediately had recourse to the proper treatment. I dashed a small pailful of water upon the child's head and spine, and in a few moments had the satisfaction of seeing her take a full respiration, and evince some signs of returning consciousness. I immediately administered an emetic, consisting of two grains of sulphate of zinc and ten of powdered ipecac.; this was followed by copious emesis, consisting of a large quantity of peach-keruels, emitting all the peculiar fragrance characteristic of prussic acid. Sinapisms were also applied to the spine and to the extremities, and after the vomiting had ceased, I ordered thirty drops of the aromatic spirits of ammonia in

* *American Journal of Medical Science*, January, 1851.

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water, to be repeated every half hour. The child appearing much relieved, and consciousness having entirely returned, I left the house.

Upon visiting my little patient two hours after, and finding that the pulse was full and rapid, face flushed, conjunctiva injected, and that she was complaining of violent pain in the head, I took about three ounces of blood from the arm, and ordered cold applications for the head and an enema for the bowels. When I returned again in the evening, all untoward symptoms had vanished, and the child was playing about, and apparently as well as ever.

Upon testing the contents of the stomach with the liquor potassæ and a solution of the sulphate of iron, the Prussian blue was instantly precipitated in abundance. From the condition in which I found the child, I have every reason to believe that had not the proper remedies been promptly applied, life would have soon become extinct.

MODIFICATION IN THE PREPARATION OF GUN COTTON.

BY M. GAUTHERIN.

	Gr.
Monohydrated nitric acid.....	200
Commercial sulphuric acid.....	400
Carded Cotton.....	q. s.

I put the two acids into a porcelain capsule of the capacity of a quart, adding the cotton well carded and free from any impurity. At the end of some time, eight or ten minutes, according to the temperature of the air, I remove the cotton from the liquid, and press it between two glass rods, so that the acid with which it is impregnated may escape to serve for a second operation; I then wash the cotton in pure water, taking care to squeeze it strongly.

ON THE PRESENCE OF MINERAL POISONS IN THE NERVOUS SYSTEM AFTER DEATH BY ACUTE POISONING.*

BY DR. ROUCHER.

Dr. Roucher (of Strasbourg) has undertaken a series of experiments, by the exhibition of arsenic, lead, copper and mercury, to dogs, with the view of ascertaining if these poisons can in reality be detected in the cerebrum and spinal cord.

Arsenic was twice found in the substance of the brain.

Mercury was found in each instance of three experiments of poisoning by mercury.

Copper was discovered in five instances out of six of poisoning by the sulphate. In three cases the proportion of the oxide varied from three to six thousandths.

The brain of dogs not poisoned yielded scarcely an appreciable quantity.

Lead was extracted in the proportion of eighteen thousandths from the brain of a dog which died at the end of three days, from acetate of lead.

These facts induce the author to think that the mineral as well as organic poisons exert a direct influence upon the nervous centres.

Comptes Rendus, No. 17, April 28, 1851.

DETECTION OF DATURIA IN THE URINE.*

In 1824, Runge asserted that, in cases of poisoning by hyosciamus, belladonna, and stramonium, the active principles of these poisons might be detected in the urine of persons subjected to their action, by means of the property they possess of dilating the pupil when applied to the eye of another animal.

The accuracy of this fact has always been involved in doubt. In 1847, M. Allan found daturia in the urine of a man who had been poisoned by stramonium. Since then, he has detected the same in two other cases of poisoning. In both cases, this substance was detected by means of Henry's process.

DEATH OF RICHARD PHILLIPS, ESQ., F.R.S.

It is with great regret that we have to announce the death, on the 11th of May, after an illness of only a few days' duration, of Mr. Richard Phillips, the eminent chemist, whose researches in pharmaceutical and other branches of chemistry are well known to our readers. He was formerly Lecturer on Chemistry at Grainger's School, and afterwards at St. Thomas's Hospital. For several years he has filled the office of Curator of the Museum of Practical Geology, and has devoted his attention to that department of chemistry connected with patent inventions, the arts and manufactures. Mr. Phillips was in his 73rd year.

* *Journal de Chimie Médicale*, May, 1851.

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TERIODIDE OF ARSENIC.*

BY M. GÖPEL.

M. G. has made some experiments upon the best method of preparing iodide of arsenic, AsI^3. He found it to be as follows:—Two drachms of iodine and one drachm of finely powdered arsenic are mixed and maintained infusion for some time on a digesting flask, upon a sand-bath at as low a temperature as possible; the mixture, when cool, is treated with four ounces of cold alcohol, the solution is poured off from the residual arsenic, its color reduced to wine-yellow by subjection to a current of arseniuretted hydrogen, and then evaporated immediately, at a temperature not exceeding 122° F. until it crystallises. With respect to the method proposed by Meurert, of passing arseniuretted hydrogen into an alcoholic solution of iodine, Göpel states that the former may contain free hydrogen without injury to the process, and that the treatment with the gas could be interrupted when the wine becomes of a pale wine-yellow color; he found that the chocolate-brown powder, deposited after too long a treatment of the liquid with arseniuretted hydrogen, was composed according to the formula AsI.

NEW MODE OF ADMINISTERING CHLOROFORM.

DR. YVONNEAU (of Blois) submitted to the notice of the Academy a particular manner of administering chloroform in exact doses, and free from all danger. Dr. Yvonneau's method consists in the enclosure of the chloroform in capsules of crystallised sugar, containing each one or two drops of chloroform. This method had been successfully employed in a case of obstinate hiccup; in another of hysteria; and in a case of vomiting.

USES OF MATICO.

M. CAZENBRE transmitted an essay in which he submitted the following conclusions:—1. That matico is an excellent means of facilitating the healing of recent wounds; that it is especially useful after operations, in promoting union by the first intention; that it has a remarkable effect in arresting traumatic hæmorrhage; that it is the most certain remedy for the arrest of hæmorrages from internal causes; lastly, that matico, by its aromatic, tonic, and astringent properties, is also fitted to fulfil other therapeutic indications.

* Liebig's *Annual Report.*
† *Annual Report*, for 1847 and 1848, i., 325.

CHLOROSIS IN A MALE.

M. MARCHAL (of Calvi) communicated a case of chlorosis occurring in a subject of the male sex, and in which a notable diminution of red blood globules was observed.

TISANE IN ASTHMA.

BY M. DEBREYNE.

Montpellier camphor.....	50 grs.
Water	1 quart.

Infuse. To be taken during the day. This infusion has been equally useful in fumigation.

TINCTURE IN MYOPIA.

BY DR. TURNBULL.

Ginger.....	100 gr.
Rectified spirit	200 ,,

F.S.A. This tincture is to be rubbed on the forehead for ten minutes occasionally.

TO CORRESPONDENTS.

INTRODUCTION TO THE STUDY OF CHEMISTRY.—*Erratum.*—Page 290, col. 2, line 16 from bottom; for "57" read 62. The five elements omitted in the table were—

Didymium.	Erbium.	Niobium.
Pelopium.	Terbium.	

"A STUDENT." We shall be happy to give you any advice in our power.

"M.P.S.G.B." You should get your brethren to act.

"A. B." will find another formula for soluble iodide of starch in the present number.

"Z." We will write to the address given in a day or two.

"PHARMACIEN" is right in his views.

By a mistake of our printer, the Nos. of THE CHEMIST for March and April were wrongly numbered; they should have been XVIII and XIX, instead of XIX and XX.

NOTICE.—*All Communications, Books for Review and Substance for Notice must be addressed* "To the Editors of THE CHEMIST, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following No., will in future be received as late as the 24th.*

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

ON THE DIFFUSION OF LIQUIDS.

BY THOMAS GRAHAM, ESQ., F.R.S., F.C.S., PROFESSOR OF CHEMISTRY IN UNIVERSITY COLLEGE.

THE experiments described in the author's former paper on this subject furnished strong grounds for believing that isomorphous salts possess a similar diffusibility. All the salts of potassa and ammonia which were compared, appeared to be equidiffusive; so also were the salts of certain magnesian bases. A single preliminary observation on the nitrates of lead and baryta, however, opposed the general conclusion, and demanded further inquiry. It is scarcely necessary to say that any new means of recognising the existence of the isomorphous relation between different substances, must prove highly valuable. Let us inquire therefore how far liquid diffusion is available for that purpose.

The salts were still diffused from weak solutions, that is from solutions containing from 1 to 8 per cent. of salt; but now a measure of the solution, equal to 100 grains of water, was made to contain 1 grain of the salt, to form what is called the 1 per cent. solution, instead of 1 grain of salt being added to 100 grains of water, as before, without reference to the condensation which generally occurs. The quantities 1, 2, 4, and 8 per cent. thus indicate the parts of salt present in a constant volume of liquid,—as 10, 20, 40, and 80 grains of the salt in 1000 water grain-measures of the solution. The same phials for the solution and jars for the external water-atmosphere continued to be used, and the manipulations were similar. It is believed, however, that the temperature of the liquids was maintained more uniform in the new experiments than the old, partly by the better regulation of the temperature of the apartment, and partly by placing the jars close together upon a table with upright ledges, and covering the whole over with sheets of paper during the continuance of an experiment. The mass of fluid in 80 or 100 jars, which were employed at once and placed together, made the small oscillations of temperature, which might still occur, slow and less injurious.

The investigation is also extended to several new substances, such as hydrocianic acid, acetic acid, sulphurous acid, alcohol, ammonia, and salts of organic bases, without reference to isomorphous relations. It is very necessary to have data which are minute and accurate respecting the diffusion of a considerable variety of substances. This it is the object of the present investigation to endeavor to supply, leaving speculative deductions in general respecting the nature and laws of liquid diffusion for a future occasion.

The density of all the solutions was observed at a constant temperature, namely, 60° Fahr.

1. *Hydrochloric acid.*—The period of diffusion arbitrarily chosen for this acid was five days. The diffusate, or quantity of acid diffused, was determined by precipitating the liquid of the external reservoirs with nitrate of silver, and

* *Quarterly Journal of the Chemical Society.*

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weighing the chloride of silver formed. In the 1 and 2 per cent. solutions, the liquids of two jars were generally mixed and precipitated together.

The number of cells diffused at once, unless otherwise specified, was always eight cells, of the 1 and 2 per cent. solutions, and four cells of the 4 and 8 per cent. solutions. In this abstract the means only of these experiments are given.

The diffusates at the same temperature were found to be as follow:

Diffusion in five days at 51° Fahr.: two cells.

	Grs.	Ratio.
From 1 per cent. solution	7·41	0·97
From 2 per cent. solution	15·04	2·00
From 4 per cent. solution	30·72	4·00
From 8 per cent. solution	67·68	9·00

The 2 per cent. solution is taken as a standard of comparison for the ratios, instead of the 1 per cent. solution, from the greater accuracy with which the diffusion of the former can be observed.

The increasing diffusibility with the larger proportions of acid here observed is unusual, at least in the degree exhibited by the 8 per cent. solution. Other substances, as will be immediately perceived of nitric acid, appear to lose proportionally in diffusibility as their solutions are concentrated.

Hydrochloric acid belongs to the most diffusive class of substances known; it appears to exceed hydrate of potassa at 53°·5, as 7·56 to 6·12, or as 100 to 80·9*.

The rapidity with which hydrochloric acid diffuses, and the facility with which that substance may be estimated, induced the author to examine the progression with which its diffusion takes place with increasing times in a minute manner. The 2 per cent. solution was diffused for times increasing by six hours, from twelve hours or 0·5 day to 4·75 days, six cells being diffused for every period. Instead of determining the acid diffused separately in each jar or pair of jars, the contents of the six jars of each experiment were mixed together, and a definite proportion of the liquid precipitated by nitrate of silver, and the chloride of silver weighed, so as to obtain at once the mean result. Another observation for 5·75 days is added, although made at a sensibly higher temperature.

The differences are evidently affected by accidental errors of observation. The diffusion in 3·5 days is also increased by a rise of temperature of more than 1° in that and the following experiments. The diffusion always increases with the time, but less rapidly, according to a gradual diminishing progression.

Diffusion of hydrochloric acid, 2 per cent. solution; one cell.

Time.	Temperature.	Diffusate in grains.	Differences.
DAYS.	°		
0·5	53·75	0·909	
0·75	53·75	1·312	·403
1	53·75	1·766	·454
1·25	53·75	2·353	·587
1·5	53·75	2·596	·243
1·75	53·58	3·178	·582
2	53·58	3·410	·232
2·25	53·42	3·967	·557
2·5	53·58	4·339	·372
2·75	53·50	4·618	·279
3	53·50	4·969	·351
3·25	53·50	5·304	·335
3·5	54·85	5·857	·553
3·75	54·85	6·254	·397
4	54·85	6·407	·153
4·25	54·85	6·795	·388
4·5	54·71	7·034	·239
4·75	54·71	7·473	·339
5·75	56·46	8·363	

2. *Hydriodic acid.*—Time of diffusion five days, as for hydrochloric acid. The acid diffused was estimated from the weight of iodide of silver which it gave when precipitated by nitrate of silver.

Diffusion from 2 per cent. solutions at 51° Fahr.

Hydrochloric acid....	15·04	100
Hydriodic acid	15·11	100·46

These experiments indicate a similarity of diffusion between the two isomorphous substances, hydrochloric and hydriodic acids.

Hydrobromic acid.—Time of diffusion five days. The diffusate was estimated from the bromide of silver.

Diffusate from 2 per cent. solutions at 59°·7 Fahr.

Hydrochloric acid....	16·55	100
Hydrobromic acid....	16·58	100·18

Hydrobromic acid appears therefore to coincide in diffusibility with hydrochloric acid at this temperature. It may be remarked that these three acids, hydrochloric, hydrobromic and hydriodic, do not exhibit the same correspondence in another physical property, namely, the densities of their aqueous solutions containing the same proportion of acid. The densities of 2 per cent. solutions of hydrochloric and hydriodic acids appear to be respectively, 1.0104 and 1·0143 at 60° Fahr., and that of hydrobromic acid

* Phil. Trans. 1850, 39.

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is an intermediate number. The same acids are also known to differ considerably in the boiling-points of solutions containing the same proportion of acid. A considerable diversity of physical properties appears here to be compatible with equal diffusibility in substances which are isomorphous.

Bromine.—Pure water readily dissolves more than 1 per cent. of this substance. The solution prepared, however, contained only 0·864 per cent. of bromine, as was ascertained by treating it with sulphurous acid and afterwards precipitating by nitrate of silver. Its density was 1·0070. It was evident, from the slow appearance of the brown color in the exterior cell, that bromine diffuses less rapidly than hydrobromic acid.

The diffusion-time of bromine was made ten days, or double the time of hydrobromic acid. Two cells contained together a diffusate of 5·80 grains of bromine; another two cells a diffusate of 5·88 grains; mean 5·84 grains, at 60°·1 Fahr.; or 6·76 grains for a 1 per cent. solution. Doubling the last result we have 13·52 grains for a 2 per cent. solution, which is still considerably under the diffusate of hydrobromic acid (16·58 grains) in half the time.

3. *Hydrocyanic acid.*—Time of diffusion five days. The acid diffused was estimated from the cyanide of silver which it gave with nitrate of silver.

Hydrocyanic acid, 1·766 per cent., made up to a density of 1·10142 with sulphate of potassa. Diffused at 64°·2, in six cells, 11·40, 11·86, 11·80; mean 11·68 grains for two cells. Calculated for 2 per cent., 13·23 grains at 64°·2 in two cells, or about 13·10 grains at 62°·8, assuming this acid to be affected in the same way by temperature as hydrochloric acid.

Hydrocyanic acid here appears less diffusive than hydrochloric acid, at the same temperature 62°·8, as 13·10 to 16·40, or as 79·6 to 100, and not to belong therefore to the same class of diffusive subjects.

4. *Nitric acid.*—Time of diffusion five days. The quantity of this acid diffused was always determined with great exactness by neutralization by means of a normal solution of carbonate of soda.

The diffusion of the different proportions of this acid at one temperature is as follows:

Diffusion of nitrate of water in five days at 51°·2; two cells.

	Grs.	Ratio.
From 1 per cent. solution	6·99	0·95
From 2 per cent. solution	14·74	2
From 4 per cent. solution	28·76	3·90
From 8 per cent. solution	57·92	7·86

The usual approach to equality of diffusion between chlorides and nitrates is observable in hydrochloric and nitric acids, at least in the 1 and 2 per cent. solutions.

Diffusion from 1 per cent. solution at 53°·5.

Hydrochloric acid	7·56	100
Nitrate of water.....	7·28	96·3

Diffusion from 2 per cent. solution.

Hydrochloric acid at 51°·	15·04	100
Nitrate of water at 51°·2	14·74	98·0

The 2 per cent. solutions of both acids were also diffused at higher temperatures.

Diffusion from 2 per cent. solution.

Hydrochloric acid at 62°·8 .	16·46	100
Nitrate of water at 63°·2 . .	16·76	101·8

Here the diffusibility of the two acids is as nearly as possible equal.

Diffusion from 4 per cent solution.

Hydrochloric acid at 51° .	30·72	100
Nitrate of water at 51°·2 .	28·76	93·7

Diffusion from 8 per cent. solution.

Hydrochloric acid at 51° .	67·68	100
Nitrate of water at 51°·2 .	57·92	85·3

The wide divergence between these two acids, in the 8 per cent. solution, is produced by the remarkably increased diffusion of hydrochloric acid in that high proportion.

5. *Sulphuric acid.*—That time of diffusion arbitrarily chosen for this acid was ten days. The diffusate of this acid was determined in the same manner as that of nitric acid.

The diffusion of the different proportions of sulphuric acid is as follows:—

Diffusion of sulphate of water in ten days at 49°·7; two cells.

	Grs.	Ratio.
From 1 per cent. solution	8·69	1·03
From 2 per cent. solution	16·91	2
From 4 per cent. solution	33·89	4·01
From 8 per cent. solution	68·96	8·16

The diffusibility of different strengths of this acid appears to be pretty uniform, but with a slight tendency to increase in the higher proportions, like hydrochloric acid.

Sulphuric acid is inferior in velocity of diffusion to hydrochloric acid, but still it appears to possess considerably more than half the diffusibility of the latter.

6. *Chromic acid.*—Time of diffusion ten days. The diffusates from four cells of

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the 2 per cent. solution were mixed together, and the quantity of chromic acid diffused for two cells reduced by means of hydrochloric acid and alcohol, and weighed as oxide of chromium.

1·762 per cent. of anhydrous chromic acid, density 1·01404, diffused at 67°·3, gave 19·78 grs. of chromic acid in two cells. Calculated for 2 per cent., 22·43 grs. of chromic acid, in two cells at 67°·3. The diffusion of sulphuric acid at 63°·5, was 19·73 grs., which would give about 21 grs. of that acid at 67°·3.

7. *Acetic acid.*—Time of diffusion ten days. This acid cannot be determined accurately by the acidimetrical method, owing to the acetates of potassa and soda being essentially alkaline to test paper, like the carbonates of the same bases, although neutral in composition. The weight of carbonate of baryta dissolved by the acid was had recourse to.

Diffusion of acetate of water in ten days at 48°·8; two cells.

	Grs.	Ratio.
From 2 per cent. solution	11·31	2
From 4 per cent. solution	22·02	3·83
From 8 per cent. solution	41·80	7·26

The diffusibility diminishes with the larger proportions of acid. This acid appears to be considerably less diffusive than sulphuric acid. I was led to over-estimate the diffusion of acetic acid in a preliminary observation of my former paper, by trusting to the acidimetrical method of determination. Hydrochloric acid appears to diffuse about two and a half times more rapidly than acetate of water, at the same temperature.

8. *Sulphurous acid.*—The time of diffusion chosen for this acid was ten days, for comparison with sulphuric acid. The usual number of eight cells of the 1 and 2 per cent. solutions were diffused, and four cells of the 4 and 8 per cent. solutions. The whole diffusates of each proportion were then mixed together, and the proportional quantity of liquid representing two cells in the 1 and 2 per cent. solutions, and 1 cell in the 4 and 8, was converted into sulphuric acid by a slight excess of bromine, and determined from the sulphate of baryta.

Diffusion of sulphurous acid in ten days at 68°·1; two cells.

	Grs.	Ratio.
From 1 per cent. solution	8·09	0·954
From 2 per cent. solution	16·96	2
From 4 per cent. solution	33·00	3·821
From 8 per cent. solution	66·38	7·827

This substance appears to be less diffusive than sulphuric acid at the same temperature; the diffusion of sulphurous acid at 68°·1 considerably resembles that of sulphuric acid at 49°·7.

9. *Ammonia.*—The time of diffusion chosen was 4·041 days, or that of hydrate of potassa with chloride of sodium at seven days. The whole diffusates of each proportion were mixed together, and the quantity of ammonia diffused for two cells determined by an alkalimetrical experiment, which was always repeated twice. It was necessary for diffusion to have the ammoniacal solution made denser than water, which was effected by the addition of common salt.

Diffusion in 4·04 days at 63°·4; two cells.

	Grs.	Ratio.
From 1 per cent. solution	4·93	1·029
From 2 per cent. solution	9·59	2
From 4 per cent. solution	19·72	4·117
From 8 per cent. solution	41·22	8·605

Ammonia appears to have a diffusibility approaching to that of hydrate of potassa. It appears somewhat less diffusive than hydrocyanic acid at the same temperature, in the proportion of 12 to 13 nearly; or to possess about three-fourths of the diffusibility of hydrochloric acid.

10. *Alcohol.*—Time of diffusion ten days. The quantity of alcohol diffused was determined by careful distillation.

Diffusion in ten days at 48°·7; two cells.

From 2 per cent. solution.....	8·62
From 4 per cent. solution	16·12
From 8 per cent. solution.....	35·50

It would be unsafe to draw any conclusion as to the proportionality of the diffusion of alcohol to the strength of the solution from these experiments.

Alcohol does not appear to belong to the same class of diffusive substances as acetic acid, which might be expected from their similarity of composition, but possesses a considerably lower diffusibility.

Diffusion from 2 per cent. solutions in ten days.

Acetate of water at 48°·8 ..	11·51	100
Alcohol at 48°·7	8·62	74·9

The diffusion of alcohol approaches to one-half of that of sulphate of water, at nearly the same temperature.

Alcohol may be substituted for water to dissolve certain salts, and also as an atmosphere into which these salts may diffuse. From experiments which have been commenced on this subject, it appears that the

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diffusion of hydrate of potassa, iodide of potassium, chloride of calcium and others is about four times slower in alcohol of density 0·840 than in water. The salts likewise often exhibit the same relations in their diffusibility in alcohol, as in water, with some singular exceptions, such as chloride of mercury.

11. *Nitrate of baryta.*—Time of diffusion 11·43 days.* The salt diffused was precipitated by sulphuric acid, and calculated from the weight of the sulphate of baryta formed.

Diffusion in 11·43 days at 64°·1; two cells.

	Grs.	Ratio.
From 1 per cent. solution	7·72	1·026
From 2 per cent. solution	15·04	2
From 4 per cent. solution	29·60	3·936
From 8 per cent. solution	54 50	7·247

12. *Nitrate of strontia.*—Time of diffusion 11·43 days. Of anhydrous nitrate of strontia 0·82 per cent.; density 1·0063. Diffused at 51°·5, in eight cells, 5·59, 5·62, 5·44, 5·69; mean 5·59 grs. for two cells; calculated for 1 per cent., 6·79 grs. at 51°·5 for two cells.

The diffusion of nitrate of strontia almost coincides with that of the isomorphous nitrate of baryta at the same temperature.

Diffusion from 1 per cent. solutions at 51·05 in 11.43 days.

Nitrate of baryta....	6·73	100
Nitrate of strontia....	6·79	100.89

13. *Nitrate of lime.*—Time of diffusion 11·43 days. The diffusate was evaporated to dryness with an excess of sulphuric acid, and the nitrate of lime, which is always supposed anhydrous, was estimated from the sulphate of lime produced.

Diffusion in 11·43 days at 64°·1; two cells.

	Grs.	Ratio.
From 1 per cent. solution	7·66	1·021
From 2 per cent. solution	15·01	2
From 4 per cent. solution	29·04	3·872
From 8 per cent. solution	55·10	7·334

The results throughout for this salt are almost identical with those of nitrate of baryta, although these two salts differ greatly in solubility, and in one being a hydrated, and the other an anhydrous salt.

(To be continued.)

* This time is to that of sulphate of magnesia (16·166 days) as the square root of 8 is to the square of 16; but does not appear to express the true relation between these salts.

MEMOIR ON THE CHEMICAL NATURE OF THE CHUFA (CYPERUS ESCULENTUS).*

BY RAMON TORRES MUNOZ Y LUNA, PROFESSOR OF CHEMISTRY IN THE UNIVERSITY OF MADRID.

In 1822, M. Lesant, pharmacien at Nantes, presented to the Academic Society of the Lower Loire, a note on the chemical composition of the tubercles attached to the root of the Cyperus Esculentus of Linnæus.

The results of his analysis, which was entirely qualitative, enabled M. Lesant, at that period, to show the importance to which the cultivation of the cyperus might attain in certain parts of France. The advantages which this culture presents more particularly in Spain, where this tubercle abounds, have induced me to resume the study of it in a chemical point of view. I have thought that by applying to the analysis of this product the improved means which science now has at command, some new and interesting facts might result from this examination, which might easily have escaped the most attentive observer thirty years ago.

I have the honor of presenting to the Academy the results of my work, which has been executed at Paris, in the laboratory of M. Wurtz.

CHARACTERS AND STRUCTURE OF THE CYPERUS ESCULENTUS.

The length of these tubercles when they are saturated with water, is, on the average, about 2 centimetres; when dry, they are scarcely half of their original size. They are inodorous, of brownish color, of a sweet and agreeable taste, somewhat similar to that of hazel nuts.

In contact with water, they absorb 58 per cent. of that liquid: this water evaporates in a few days when the moistened tubercles are left in the open air.

Their tissue is perfectly homogeneous, of a dull white like milk, very firm and hard; each tubercle has in the direction of its length a circular range of vascular fibrous bundles; these bundles are noticed as a circle of small yellowish points towards the middle of the transverse section of the tubercles. I will not stop to describe the structure, which is the same as that of most vascular plants, and which consists of tracheæ and cloisters, or elongated, narrow, fibrous cellules, filled with a colorless and scarcely granular liquid.

The tracheæ themselves are very narrow, (about 0·12mm) and very much pressed against each other. The cellules which form

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them by being superposed on each other, terminate in conical points. The cloisters are not numerous; each tubercle is surrounded by a brownish bark formed of flattened cellules, not very regular, which are often detached in sheets and do not exist on the dried tubercles. Beneath is found a single layer of yellowish cellules with very thick sides; they are filled with a yellowish liquid containing some molecular granulations; all the rest of the tissue of the tubercle is cellular tissue, having every where the same structure. It is formed of polyhedral cellules, with thin sides, of a diameter varying between 0·30mm and 0·55mm. The matter contained in these cellules is very peculiar and very interesting to study.

They are entirely filled with grains of fecula and oily granulations. It is difficult to determine which of these two substances predominates; however, the fecula generally constitutes the greater portion of the contents, and the oily granulations are in the interstices of the grains of fecula. From the accumulation of these two bodies it results that the cellules are almost opaque and, for that reason, difficult to study when a very thin section of them is made.

The broken cellules readily allow their contents to escape. It is then perceived that the grains of fecula are small; the largest do not exceed 0·020mm. The smallest are only 0·004mm to 0·006mm. They are generally spherical, spheroïd or ovoïd, sometimes rather triangular on the edges. Very few of them present concentric lines, round an umbilicus like the grains of potato fecula.

The oily granulations are all of nearly the same size and very small; they do not exceed 0·001mm; they may be collected in drops of variable bulk if the tissues be too much crushed in making the preparation. They are all yellowish, with a brilliant centre, and deep blackish edges. These give to the cellules their opacity.

When they are collected into rather a large heap, light does not easily pass through them; their size, color, and always spherical form prevent them from being confounded with the grains of fecula with which they are always mixed.

Like all small granulations, especially those of fatty nature, they are endowed with the Brownian motion.

From the study of the structure of these tubercles it results:—

1. That the fecula and the oily grain are contained in the same cellules and not in distinct cellules:

2. That this oil is in the state of emulsive drops, as the fat oils ordinarily are, and not in the state of a homogeneous liquid.*

QUANTITATIVE ANALYSIS OF CYPERUS ESCULENTUS.

According to my analyses, this tubercle contains in 100 parts:

Water	7·10
Oil	28·06
Fecula	29·00
Cane-sugar	14·07
Albumen	0·87
Cellulose	14·01
Gum, coloring matter, salts and loss	6·89
	100·00

I shall now briefly detail the processes which I adopted for estimating each of these principles, whose principal chemical properties I shall at the same time carefully indicate.

ESTIMATION AND PROPERTIES OF THE OIL.

After having extracted, by simple pressure, 17 per cent. of the oil contained in the souchet, I used ether to estimate the fatty matter remaining in the pressed cake; to exhaust it conveniently, I made use of M. Payen's ingenious process for continuous distillation.

The following are the results I obtained:

Weight of the matter	83·21
Weight of matter exhausted by ether	59·86
Weight of oil extracted by pressure	14·25
Weight of oil extracted by ether	9·10

This oil is fluid at the ordinary temperature; yellow, like olive oil; transparent and inodorous: its taste resembles that of lard, but less intense: it solidifies at 32° F.; its density is about 0·9190 at the temperature of 54° F. It readily saponifies with the caustic alkalis and oxide of lead. The soaps which are obtained have all the properties of the soaps of olive oil or almond oil. In contact with hyponitric acid or nitrate of mercury, it solidifies; it is insoluble in alcohol, completely soluble in ether, and burns with a very luminous flame.

To ascertain the nature of the fatty matters which form this oil, I saponified it by potassa, and I precipitated the soap obtained by common salt. After having freed it from the mother liquors by pressure, I redissolved it in water and precipitated by acetate of lead. The lead soap obtained was dried and exhausted by ether. The part soluble in ether was oleate of lead,

* I owe these anatomical details to the kindness of Dr. Robin.

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from which I extracted the oleïc acid, possessing all the characters of that acid. The portion insoluble in ether was decomposed by weak nitric acid, and furnished a fatty acid which solidified on cooling and which was purified by several crystallisations in alcohol. In the pure state it was under the form of small papillæ fusible towards 131° F., very soluble in alcohol with the aid of heat, and very readily depositing from the alcoholic solution by cooling. Unfortunately, the quantity of pure matter which I had at my disposal was not sufficient for an organic analysis, so that it was impossible to decide whether this solid acid was margaric acid or some other acid belonging to the same series. For the same reason, I have not been able to study as I wished, a solid, white crystalline substance, fusible at 86° F., which deposits and remains in the solid state at the bottom of the oil when left to itself.

I hope to supply these deficiencies when I have at my command sufficient quantities.

ESTIMATION AND PROPERTIES OF THE SUGAR.

After completing my researches on the presence of the oil and its estimation, I applied myself to determining the nature and quantity of the saccharine principle contained in the substance under examination. The oil having been extracted by simple pressure, I submitted the pulp to maceration in water; the liquid thus obtained had a very perceptible sweet taste. I had recourse in the first instance to an optical process of saccharimetry for determining both the nature and the quantity of the sugar contained in the liquor. For this purpose, I followed the practical method proposed by M. Clerget, and which is based on the beautiful studies of M. Biot.

The liquid was defecated and clarified by means of subacetate of lead, and then examined with M. Soleil's saccharimeter. Several experiments, each made with 100 grammes of pulp, furnished a water of maceration, giving with the saccharimeter direct notations, which would have detected the presence of 15 or 16 per cent. of sugar for the weight of the substance, if no other principle acting on polarised light were present in the liquor; but in proceeding afterwards by inversion, that is to say by treating this liquor by hydrochloric acid, with all the precautions prescribed for this mode of testing, I ultimately estimated the quantity of crystallisable sugar ($C^{12}H^{11}O^{11}$) contained in the pulp, at 14 per cent. as a mean.

The proportion of sugar once determined, I sought a practical means of extracting this substance in the large way.

I had to combat the obstacle which the soluble substances, mineral salts, gum, alumen, &c., mixed with sugar, opposed to the crystallisation.

A simple approximation between the density which sugar alone would have given to the liquor, and the effective density of this same liquor, sufficed to show that that the weight of these substances was equal to about half the weight of the sugar. This composition is evidently less favorable to the separation of the sugar than that of the juice of the cane, in which the heterogeneous matters are in smaller quantity; as regards the weight of these matters, and setting aside their nature, this composition is very similar to that of the juice of beet roots. However, I experienced more difficulties in the extraction of the sugar than I met with in treating beet-roots.

The concentration of the juice simply defecated with lime and filtered through animal charcoal gave me only a viscid mass, in which very few and very small crystals were formed. I then tried the process which M. Peligot employed in the analyses of cane juice.

It is known that this process consists in the first place in evaporating the defecated juice to the consistence of a syrup; in redissolving the juice in boiling alcohol and evaporating again in vacuo without heat over a capsule containing quick lime.

I have thus already obtained results far superior to the foregoing; very white and perfectly defined crystals have been separated, but still not feeling perfectly satisfied, I had recourse to the treatment by baryta, recently introduced by M. Dubrunfaut, and this process enabled me to extract at once 9 per cent. of very pure and well crystallised sugar. I have the honor of exhibiting this sugar to the Academy.

There remained in the mother liquors about 4 per cent. of sugar; I had therefore lost in the manipulations about 1 per cent. of this substance. The repetition of the treatment by baryta on the mother-liquors would very probably have given almost all the sugar they contained, but their quantity was too small for this quantitative treatment to be easily applied to them. I merely ascertained by means of the microscope that crystals were still formed in the last traces of the residue.

ESTIMATION AND PROPERTIES OF THE FECULA.

To estimate the fecula contained in the

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edible cyperus, I wished at first to employ the mechanical process which is used for the extraction of potato fecula. But I was compelled to renounce its employment, because the cellulose, itself finely divided, likewise passes through the finest sieves, and because it is consequently impossible to arrive at accurate results. I have, therefore, endeavored to estimate the fecula by an indirect means, which has given me satisfactory results, and which I shall now briefly describe.

This process is based on the facility with which weak sulphuric acid converts starch into glucose, and on the possibility of estimating the latter with great accuracy by means of M. Soleil's saccharimeter.

It will easily be understood that if it were required to estimate starch in a substance containing no sugar, nothing could be more simple than the estimation in question. The proportion of glucose obtained would enable us to calculate, by means of a simple proportion, the quantity of starch which contributed to its formation. But it is not thus: the sugar naturally contained in the cyperus is itself converted into glucose by the action of the dilute acids; only this glucose, this interverted sugar, as it is called, is distinguished from sugar of fecula by the property it possesses of deviating to the left the plane of polarisation. If, therefore, we analyse by means of M. Soleil's saccharimeter, a liquid containing at once sugar of fecula and interverted sugar, complex results must be obtained, one of these substances deviating the plane of polarisation to the right, and the other to the left, but it will always be easy to analyse and interpret the results obtained provided that we know exactly the proportion of one of the sugars, of the interverted sugar for example. This is precisely the case of our analysis.

When a given weight of cyperus is treated with dilute sulphuric acid, we know the quantity of crystallisable sugar which it contains and its rotatory power to the right, and it is known beforehand that the interverted sugar which will be formed by the action of the acid will have a rotatory power to the left equal to its original power to the right. As this rotatory power to the left is exerted in the inverse direction of the rotatory power to the right of the sugar of fecula obtained, it is evident that, to arrive at the true deviation due to the latter sugar, it will be necessary to add to the deviation to the right observed the deviation to the left due to the interverted sugar, which it is easy to calculate.* This being done, this analysis becomes very simple; 45 gr. of cyperus, divided with the greatest care, and sifted, were treated with distilled waters to which was added 4 per cent. of sulphuric acid, and heated for some hours by means of a current of steam.† I thus obtained 550cc of a liquor in which the fecula was converted into glucose, and the sugar into interverted sugar. The liquid, examined with the saccharimeter after having been defecated with subacetate of lead, gave a deviation of 13 divisions, including a tenth for defecation.‡

But it is known that 45gr of matter contain 6gr33 of crystallisable sugar which, for a volume of 550cc give a deviation towards the right of 9 divisions. Converted into interverted sugar, these 6gr33 give a deviation towards the left of three divisions; consequently, to obtain the deviation to the right due to the sugar of starch, these 3 divisions must be added to the 13 divisions observed. This amounts to saying that the fecula contained in 45gr of cyperus furnished a quantity of glucose producing under a volume of 550cc of liquor a deviation towards the right of 16 divisions. The cypher of 16 divisions expresses in grammes the quantity of glucose obtained. According to a calculation of equivalents very easily made, 16gr of glucose correspond to 13gr09 of fecula. Consequently, cyperus contains 29 per cent. of fecula.

I have proved besides that this fecula presents all the chemical characters of potatoe fecula. The action of warm water, that of iodine, and that of potassa, produce with this fecula phenomena too well known for it to be necessary to describe them at length; I will merely add that I have observed the transformation of this fecula into lactic acid and butyric acid under the influence of albuminoid ferments.

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* It would at first appear that these calculations might be dispensed with, by freeing the crystallisable sugar contained in the cyperus by washing; but these washings are impracticable, because the grains of fecula in cyperus are of such tenuity that they pass off partly with the washing water through the filters.

† I ascertained by a direct experiment that feebly aggregated cellulose is not converted into glucose by the action of very dilute sulphuric acid.

‡ The same liquid treated by hydrochloric acid and heated to 150° F, retained the same power, which clearly demonstrates that the transformation of fecula into glucose, and of cane sugar into grape sugar was complete.

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As cyperus contains vegetable albumen, when it is crushed and the pulp left in water, it soon acidifies, owing to a true fermentation, and gives rise to the formation of the two acids I have just mentioned.

ALBUMEN.

When the infusion of edible cyperus is heated an abundant coagulum of vegetable albumen is produced. I determined the proportions of this principle by collecting the coagulum and exhausting it by alcohol and ether after having dried it. 10gr000 of matter gave me 0gr087 of pure albumen, or 0·87 per cent.

CELLULOSE.

To estimate this principle, I treated the pulp of cyperus pressed and exhausted by ether, with an excess of sulphuric acid diluted with 4 parts of water. The fecula and gum were dissolved, and the cellulose remained undissolved with the extractive matters; the latter were removed by successive treatments with potassa, hydrochloric acid, and chlorine. After all these operations, the cellulose was exhausted by alcohol and ether, and then it was weighed. 10gr000 of matter gave 1gr401 of pure cellulose, or 14·01 per cent.

ASHES.

I likewise determined the proportion of ashes left by a given weight of cyperus; I found that 10gr000 of this substance left after incineration 0gr243 or 2·43 per cent. of a residue partly soluble and partly insoluble in water.

These ashes present the ordinary composition of vegetable ashes; I especially proved the presence of phosphoric acid, not only in the insoluble part in the state of phosphate of lime and magnesia, but also in the solution in the state of alkaline phosphate; they contain besides silica, sulphate of lime, and oxide of iron.

I will terminate this memoir by observing that there is nothing to prevent the cultivation and use of edible cyperus being greatly extended. In Spain this tubercle is an article of consumption of some importance. I may give some idea of this consumption by mentioning that in Madrid alone about 12,000 kilogrammes are annually consumed for the preparation of orgeat; but it would be much more important to subject this tubercle to an easily arranged mode of treatment to extract the fixed oil, the crystallisable sugar, and the fecula.

By pressure between hot plates, an oil of excellent quality would be extracted; the expressed pulp should be exhausted with water, to which $\frac{1}{100}$ of its weight of baryta should be added, to defecate and prevent fermentation. This solution, charged with sugar and saccharate of baryta, strained through a cloth and pressed, allows the chief part of the fecula to pass through, and this fecula gradually deposits, and may be purified by the ordinary processes.

With regard to the saccharine liquor, all the crystallisable sugar might be extracted by M. Dubrunfaut's process.—Read before the Academy of Sciences, Paris.

ON THE PREPARATION OF THE METALLIC ACIDS.*

BY SENOR ALVARO REYNOSO.

THE facility with which the permanganate of potassa yields its oxygen has led me to think that it would be possible, by operating in the presence of potassa, to prepare certain salts of the metallic acids, some of which had hitherto been obtained only by the dry way.

I at first tested the action of a mixture of permanganate of potassa and caustic potassa on a salt of sesquioxide of chromium. The reaction was instantaneous at the ordinary temperature. By filtering to separate the oxide of manganese produced and getting rid of the excess of permanganate of potassa by means of an organic body, paper for example, a liquor is obtained which contains only chromate of potassa with an excess of alkali. This reaction is so clear, that it may be employed for detecting traces of chrome; indeed, it is sufficient for that purpose to operate as we have said on the liquor to be examined, and to prove, in the liquor freed from excess of alkali by means of acetic acid, all the properties of the chromates. To the foregoing character must be added the formation of perchromic acid by means of oxygenated water: perchromic acid is soluble in ether, which it colors of a violet blue, however small may be its quantity. This formation of perchromic acid, which is as elegant as sensible, is due to M. Barreswil.

The proto-salts of antimony may also be oxidised and form antimoniate of potassa. If it be desired to prepare the granular antimoniate of potassa, which, as is known, is the test for soda, it will be sufficient to precipitate the protosalt of antimony by potassa and to redissolve the precipitate in an excess of alkali, and to add permanganate of potassa until the

* *Comptes Rendus.*

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liquor remains colored; then to get rid of the excess of permanganate of potassa, a few drops of an alkaline solution of oxide of antimony may be added.

If an organic matter be employed for destroying the permanganate of potassa, in excess, a portion of manganese will remain in solution in the potassa owing to the organic matter; this, however, is no great inconvenience, since the salt prepared should be purified by crystallisation.

When the liquor has been thus decolored, it is evaporated and cooled: small crystals of antimoniate of potassa are deposited until the washing waters contain neither chloride of potassium nor potassa.

I have remarked that when oxide of antimony is to be dissolved in potassa, it is necessary, in order that the solution may be perfectly effected, to pour the salt of antimony into the potassa; for then the oxide of antimony in the nascent state being in contact with an excess of potassa, dissolves easily, whilst, when the potassa is poured into the protosalt of antimony, the oxide of antimony agglomerates and does not completely dissolve in the potassa.

This process of preparing antimoniate of potassa has the advantage of giving in a very short time a reagent whose preparation was so very long and so delicate, that it was seldom obtained. Moreover, the importance of a rapid process for the preparation of this salt will be understood when its easy decomposition is borne in mind. Indeed, as M. Fremy has demonstrated in his memoir on the metallic acids, granular antimoniate of potassa in solution is transformed, at the end of a certain time, into gummy antimoniate and binantimoniate of potassa, so that there remains a mixture of binantimoniate and of granular and gummy antimoniate, a mixture which, precipitating not only the salts of potassa, but also all the soluble salts, might lead to error. However, M. Fremy says that he has preserved granular antimoniate in solution for several months without perceiving decomposition.

The protosalts of tin, treated in the same manner as the salts of antimony, produce stannate of potassa.

With regard to the sesquioxide of iron and the binoxide of copper, *a priori* it might be thought that they would not be converted into ferric and cupric acids, for these acids are destroyed in contact with finely divided bodies, as oxide of manganese for example, which would necessarily be formed in this reaction. The truth of this supposition has been proved by experiment.

Lead passes to the state of binoxide, but this does not combine with potassa.

The salts of bismuth produced nothing.

DISCOVERY OF A NEW METAL—DONARIUM.*

BY DR. BERGEMANN.

In the course of some experiments on the Wohlerite and Enkolite from the zirkonsyenite of Brevig in Norway, the author separated a substance, which, in its oxidized state as well as in its compounds, differed from all known simple bodies. The name of donarium, after the Teutonic god Donar, the northern Thor, has been assigned to it.

The mineral in which it occurs is easily decomposed, and forms, with hydrochloric acid, a perfectly transparent jelly, without the least residue. The separation of the different constituents presented no difficulty. The finely-powdered mineral, dried at 212°, was decomposed with hydrochloric acid, and the silica determined in the usual manner. The acid liquid filtered from the silica was treated with ammonia, and the brilliant white precipitate produced quickly placed on a filter and washed. It contained the whole of the oxide of donarium and a trace of iron; no alumina was present. The separation of the iron from the oxide of donarium might have been effected by redissolving the precipitate in an alkaline carbonate; as, however, small quantities of peroxide of iron cannot be accurately separated in this manner, it was preferred to ignite the precipitate, which by exposure to the air had acquired a yellowish, and gradually a reddish-yellow color, and then after having reduced it to a fine powder, digested it for some time with hydrochloric acid. In this manner the iron was completely separated. The oxide of donarium was collected on a filter and washed; but as the liquid which passed exhibited traces of hydrochloric acid for a long time, the oxide was again digested with a little carbonate of soda, then washed, calcined, and its weight determined. The peroxide of iron was precipitated from the hydrocloric acid solution by ammonia. The lime and other substances contained in the ammoniacal liquid separated from the oxide of donarium were determined according to the usual methods. The fol-

* *Annalen der Chemie und Pharmacie.* Von J. C. Poggendorf.

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lowing are the results of the analysis :—

Silica	17·695
Oxide of donarium	71·247
Carbonate of lime	4·042
Peroxide of iron	0·310
Magnesia and oxide of manganese	0·214
Potassa with a little soda	0·303
Water	6·900
	100·741

Assuming the silica, oxide of donarium and water to form the essential constituents of the mineral, and the carbonate of lime with the other 0·827 per cent. of substances to be merely accidental impurities, we have the following ratio :—

Silica	18·463
Oxide of donarium	74·338
Water	7·199

Oxide of donarium contains 13·072 per cent. of oxygen; consequently the oxygen ratio in the silicic acid, oxide of donarium and water is as 1 : 1 : $\frac{1}{2}$, according to which the mineral, admitting oxide of donarium to have the composition R^2O^3, will be represented by the formula $Do^2O^3SiO^3+2HO$, and the simplest name for the mineral will be *silicate of oxide of donarium*.

The *hydrate* of *the oxide of donarium* has whilst moist a white color, but gradually turns yellow. It forms a bulky precipitate, which is easily collected upon a filter, but is difficult to free entirely from the precipitant, especially when potassa or soda has been used. When dried at the ordinary temperature of the air, it forms gum-like masses of a yellow color, which furnish a reddish powder. In this state it forms a pure hydrate of the oxide, which, probably, like peroxide of iron, is capable of uniting with water in several proportions. The water is driven off at a moderately high temperature. The hydrate dissolves at the ordinary temperature in all acids, and very quickly with the assistance of heat. No chlorine is disengaged when hydrochloric acid is employed.

Metallic donarium was prepared from the oxide by heating it with potassium. The decomposition is very rapid, and with evolution of light. On treating the mass with water, the metal separates as a heavy coal-black powder. When the alkaline solution is quickly decanted and the powder washed with water, it can be kept under cold water from twenty-four to thirty-six hours without any change, but under hot water it soon turns yellowish-gray, owing to oxidation. The powder, when dry and rubbed in an agate mortar, acquires a metallic lustre. When the powder is thrown into the flame of a lamp, it burns with a reddish light into red oxide, and also when the black powder is heated in a platinum spoon. Cold and boiling hydrochloric acid have no action on the metal. Nitric acid does not act without, and but very feebly with the aid of heat. Nitrohydrochloric acid quickly converts it into red oxide, of which a small portion dissolves. Treated with sulphuric acid it is quickly converted into sulphate. This salt was found to consist of—

Sulphuric acid	31·236
Oxide of donarium	47·734
Water	21·030

Admitting that the oxygen of the sulphuric acid amounts to three times that in the oxide, we should find 6·24 parts in it, which, supposing the oxide to be R^2O^3, would give for the metal the atomic weight 997·4, and for the oxide 2294·8; or 100 parts of oxide contain 13·072 oxygen.

The oxide of donarium obtained by strongly calcining the hydrate is of a very dark red color, and forms a heavy powder. In a very fine state of division, it has an orange color, becomes darker when strongly ignited, but again paler on cooling. According to one determination, its specific gravity is 5·576. The strongly calcined oxide is not attacked by hydrochloric, nitric, nitromuriatic, nor hydrofluoric acid. Nothing is reduced or dissolved on long digestion with hydrochloric acid to which a little alcohol, sugar, tartaric or oxalic acid has been added. Only by the long-continued action of concentrated sulphuric acid is the mass rendered soluble when subsequently diluted with much water. Strongly-calcined zirconia dissolves far more quickly in strong sulphuric acid than the oxide of donarium. When, on the contrary, the oxide has only been exposed to a temperature sufficient to expel the water from the hydrate, it is slightly attacked by hydrochloric acid without any disengagement of chlorine.

The solutions of the hydrated oxide in nitric acid and sulphuric acid are colorless; that in hot hydrochloric acid is yellow, almost like a solution of iron. The color of this solution disappears almost entirely on cooling, but is again reproduced by warming.

The oxide is precipitated from its solution by potassa and soda, and is not soluble in an excess of the precipitant; ammonia behaves in a similar manner, but the precipitate is more bulky, resembling alumina precipitated by ammonia. The carbonates of potassa, soda and ammonia, as well as the bicarbonates, produce a white precipitate,

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which dissolves very readily in an excess of the precipitant. Oxalic acid immediately produces a thick white precipitate in a neutral or acid solution, which is insoluble in free oxalic acid, but can be dissolved by a large addition of hydrochloric acid and the application of heat. A concentrated solution of sulphate of potassa produces a precipitate very slowly in the sulphuric solution, which dissolves on the addition of water. Ferrocyanide of potassium furnishes a flesh-colored precipitate, verging on brown, in a neutral solution. Carbonate of baryta completely separates oxide of donarium from its solutions; sulphuret of ammonia gives a dark green flocculent precipitate, insoluble in an excess of the precipitant. Ferridcyanide of potassium, sulphuretted hydrogen and tincture of galls have no effect upon solutions of the oxide.

The oxide of donarium exhibits no characteristic reaction with the blowpipe. On charcoal alone it is unalterable; fused with soda, it forms a bead, in which the particles of the oxide float undissolved, and on cooling may easily be distinguished with a lens by their red color; with borax and with microscosmic salt it gives a yellowish bead, which on cooling becomes colorless.

ON OZONE.*

BY C. F. SCHÖNBEIN.

For some years past the attention of chemists has been directed, at different times, to Mr. Scönbein's experiments. The ingenious discoverer of gun-cotton has, indeed, undertaken to demonstrate that in the electrolysis of the air and in the action of phosphorus on the air, a peculiar matter is produced, differing from oxygen by a much higher power of oxidation; he has called this matter ozone, on account of the peculiar odor which it disengages. According to him, ozone is disengaged by the passage of lightning through the air and is manifested by a peculiar odor which is vulgarly called sulphurous.

Mr. Schönbein's experiments have been repeated by many persons, and have acquired a certain renown. The interpretation which he has given them has not found many partisans. After having for some time regarded ozone as a simple body, one of the elements of nitrogen (hydroguret of ozone) he sought to demonstrate that it should be regarded, contrary to his first hypothesis, as a peculiar degree of oxidation of water. MM. Delarive, Marignac and Berzelius, on the contrary, have given an hypothesis concerning the nature of ozone, which appears more scientific and accurate. They regard this substance as an isomeric modification (an allotropic state) of oxygen. Science now possesses too many and too striking examples of profound modification which a change in the physical state may impress on the chemical characters of one and the same substance, for this second hypothesis not to be taken into serious consideration.

Be this as it may, Schönbein procures ozone by allowing phosphorus to remain in large balloons filled with damp air, until a starched paper impregnated with iodide of potassium turns blue immediately on contact with this air. He afterwards removes the phosphorus, and to get rid of the acid formed, he washes the ozonised air with water and dries it when wanted. At the temperature of 64 to 68° F. by employing sticks of phosphorus of 6 centimetres in length and dipping one half in water, it requires about eight hours to ozonise the air of a balloon of 60 litres. Ozonised air is distinguished from ordinary air by the following characters:—Ozone contained even in very small quantity in the air, immediately decomposes iodide of potassium, liberating the iodine. Thus starched paper impregnated with iodide of potassium is instantly turned blue in an atmosphere containing ozone. In the same circumstances, yellow prussiate of potash passes to the state of red prussiate; hyponitric, sulphurous and arsenious acids undergo an easy and complete oxidation. Most of the metals are oxidised cold; the inferior metallic oxides are converted into superior oxides; coloring matters of organic origin are destroyed as they would be by the action of chlorine.

In his last communication on ozone, Schönbein describes in detail an experiment which he performed to verify his hypothesis concerning the chemical nature of ozone. If, as he maintains, ozone be really a peculiar degree of oxidation of water, the action of heat, which deprives this substance of its oxidising properties, should give rise to a disengagement of oxygen, with formation of water. This has been proved not to be the case. In passing 300 litres of ozonised air, previously washed and perfectly dried, through a glass tube powerfully heated, he did not obtain the slightest trace of water. The result upset his second hypothesis concerning the composition of ozone.

We have stated that most of the metals

* *Journal für Praktische Chemie.*

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are oxidised by ozone at the ordinary temperature. Schönbein has bestowed much care on proving this oxidation as regards silver and lead. When a current of ozonised air is passed over finely divided silver, obtained by the electrolysis of a salt of silver, the latter is gradually transformed into a velvety black powder. In this case binoxide of silver, AgO^2 is formed. It is a completely amorphous substance, tasteless at first, but gradually developing a metallic taste on the tongue: it communicates to water a slightly metallic taste and the property of restoring the color of reddened litmus paper. Hydrochloric acid instantly decomposes it with effervescence and disengagement of chlorine. The oxidation of silver by ozonised air is extremely slow; to convert two grammes of metal into binoxide, a current of ozonised air had to be passed over it for 15 days. It is a remarkable thing that polished sheet silver oxidises in ozone more rapidly than the divided metal. It is sufficient to suspend polished sheets of silver in a balloon containing powerfully ozonised air, for half an hour to find the surface of the metal covered with a blackish layer of binoxide.

Considerable interest attaches to Mr. Schönbein's experiments on the oxidation of nitrogen and on nitrification.

It is easy to observe the presence of nitric acid in the balloons in which ozone is prepared. The liquid which is extracted from these balloons contains a large quantity of phosphoric acid which may be precipitated by saturation with lime. The filtered liquid having been decomposed with carbonate of potassa, furnished by evaporation a small quantity of crystallised saltpetre. This experiment proves that by the action of phosphorus on a humid mixture of oxygen and nitrogen, there is formed, besides phosphoric acid and ozone, a small quantity of nitric acid. Schönbein attributes the oxidation of nitrogen to ozone, and, indeed, the substance which oxidises silver at the ordinary temperature, may likewise oxidise nitrogen, whatever may be its nature. The phosphorus has nothing to do with the formation of the nitric acid; this is proved by the fact that perfectly pure ozonised air, treated with lime water, likewise furnished a very appreciable quantity of nitrate of lime. 18 kilogr. of lime water having been neutralised by previously washed ozonised air, Mr. Schonbein collected a quantity of nitrate of lime which furnished, by double decomposition, 5 grammes of pure saltpetre. It is true that the quantity of ozonised air necessary for forming this saltpetre is very considerable; it requires several millions of cubic feet of air to form a quintal of saltpetre. But when we consider the immense volume of the atmosphere, this source of nitric acid is far from insufficient to explain all the phenomena of nitrification. Mr. Schonbein admits that in this experiment the combination of nitrogen with ozone (modified oxygen) is determined by the predisposing action of the alkali in contact with isolated elements. He relies on these results for giving a new interpretation of the fact of the direct combination of nitrogen and oxygen, under the influence of the electric spark.

According to him, the electric spark acts, not by determining the direct combination of the two elements, but by giving rise to the formation of ozone. The ozone afterwards oxidises the nitrogen of the air, so as to convert it into nitric acid. M. Schonbein applies the same explanation to the fact long since observed by Sir Humphry Davy, relative to the formation of nitric acid* at the positive pole of the battery, during the electrolysis of water containing a little nitrogen in solution.

ON FLUID PHOSPHORUS.†

BY J. RALLHOFERT.

THE author dissolved phosphorus in sulphuret of carbon, covered the solution with a thin layer of distilled water, and the vessel with a glass plate. After rather more than nine months, the sulphuret of carbon had evaporated, but the phosphorus remained in the fluid state. He then exposed this liquid phosphorus for four months to the rays of the sun. The phosphorus below the layer of water was still perfectly fluid, and covered on the surface with a crystalline powder. It was now boiled, and the vessel again exposed for four weeks to the sun. Neither solid nor red phosphorus was obtained. The fluid phosphorus, covered with water, was dipped into a freezing mixture; the phosphorus remained liquid under the ice.

RESEARCHES ON COBALT.†

BY M. FREMY.

SECOND ARTICLE.

MY researches on cobalt having become

* *Jahrbuch für Prakt. Pharm.*
† *Comptes Rendus*, No. 21, May 26, 1851.

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very extensive and requiring numerous analyses, I have thought that, to secure to myself priority in a work with which I have been occupied for a very long time, I will at once make known the new facts which I have definitively proved, reserving my analytical results for a complete work in which I intend to convey them.

At a recent sitting of the Academy, I announced the existence of a series of ammoniacal salts of cobalt, having for their base ammonia or its elements, combined with cobalt of various degrees of oxidation.

I shall now make known the mode of producing new salts of cobalt in which this metal is combined at once with oxygen and chlorine; the base of these salts is, therefore, a chloruretted oxide of cobalt.

When a current of chlorine is passed into an alkaline liquor holding in suspension oxide of cobalt, the brown compound which is formed, and which is generally taken for sesquioxide of cobalt, often retains a considerable quantity of chlorine, as I have ascertained by analysis.

Certain salts of cobalt are capable of directly absorbing chlorine and producing chloruretted compounds: I have ascertained that acetate of cobalt dissolves chlorine with rapidity, becomes brown, and gives a salt having for its base an oxide of cobalt corresponding to the sesquioxide, but in which part of the oxygen is replaced by chlorine.

It appeared to me interesting to ascertain if chlorine, which is absorbed by certain salts of cobalt, might likewise replace oxygen in the salts having for their base the ammoniaco-cobaltic oxides, and to prove, in a word, whether the salts of cobalt, which, when once dissolved in ammonia, so readily absorb oxygen, might, under the same influence, combine with chlorine.

But, in these new experiments, I could not operate in the presence of ammonia, which is immediately decomposed by chlorine.

It occurred to me to make hydrochloric acid react on previously formed ammoniaco-cobaltic salts; by the action of this acid, I have seen the ammoniaco-cobaltic base lose a portion of its oxygen, and acquire an equivalent weight of chlorine.

I have thus obtained a new series of salts having for their bases the chloruretted ammoniaco-cobaltic oxides.

These salts are remarkable for their beautiful red violet color. Heated in a current of hydrogen, they give perfectly pure cobalt. As these new salts are almost insoluble in water, it is always easy to separate them from the foreign bodies which ordinarily accompany cobalt. I think, therefore, that they may be used for preparing chemically pure cobalt for chemical or physical researches.

The chlorine which exists in the chloruretted ammoniaco-cobaltic oxides is in a peculiar state, for it is not immediately precipitated by nitrate of silver; this precipitation occurs only by boiling: we then have ammoniaco-cobaltic salts in which oxygen has replaced the chlorine formerly existing in the base.

It is evident, therefore, that by employing hydrochloric acid and nitrate of silver, we may obtain at will chloruretted or oxygenated ammoniaco-cobaltic combinations.

I have extended these reactions to other metals, and shall shortly communicate to the Academy the results of my experiments.

SEPARATION OF THE PROTOXIDE AND PEROXIDE OF COPPER.*

BY H. ROSE.

PROTOXIDE of copper is not precipitated from its solution in hydrochloric acid by carbonate of baryta. Hence it is a powerful base, and may be separated from the oxide of copper and other weak bases by carbonate of baryta, in which process, however, the oxidation of the protoxide of copper must be carefully prevented. This method of separation is especially applicable in the analysis of the remarkable double salt consisting of sulphurous acid combined with the protoxide and peroxide of copper.

The composition of this salt, which has been examined by M.M. Fourcroy, Vauquelin, Chevreul, Berthier, and Mr. Muspratt, was first correctly determined by Rammelsberg, who did not overlook the protoxide of copper contained in it.

PRESENCE OF AMMONIA IN HAILSTONES COLLECTED NEAR PARIS.†

BY M. MÉNE.

ON Monday, the 5th of May, there was, in Paris and its environs, a very severe hail-storm. Being at the time in my laboratory, it occurred to me to collect some of the hailstones, and analyse them. I melted them immediately in a porcelain capsule with a little hydrochloric acid, and evaporated to dryness. At the moment of almost complete reduction, I was much

* *Bericht der Academ. d. Wissenschaft. zu Berlin*, p. 102.

† *Comptes Rendus*, No. 20, May 19, 1851.

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astonished to see a small crystallisation at the bottom of the vessel. I tested some of these crystals, which weighed altogether 2gr.78, and I was convinced that they were hydrochlorate of ammonia.*

I should also notice another peculiarity; namely, that, towards the end of the evaporation, a black and carbonaceous matter was deposited in circles on the enamel of the capsule. This matter resembled the charcoal of organic matters. These stains were very numerous, and I think that they were produced by some particles in suspension in the air, for I had taken all possible care to avoid foreign matters.

ANALYSIS OF SOME METALLIC ALLOYS.†

BY C. BRUNNER.

ESTIMATION OF COPPER.

In a great number of cases the copper is separated from solutions containing it by sulphuretted hydrogen. As it is impossible to weigh directly the precipitated sulphuret of copper, it is generally redissolved in nitric acid, and the oxide of copper then precipitated by potassa. M. Brunner describes a more ready and certain method, which consists in heating the sulphuret in a glass tube, while a current of hydrogen is passed over it; it is then reduced to the state of subsulphuret, the weight of which is precisely equal to that of the oxide of copper corresponding to the same quantity of metal, ($Cu^2 O^2$).

ESTIMATION OF TIN.

The tin in alloys is generally determined by treating them with nitric acid, which dissolves the other metals, and leaves the tin in the state of insoluble stannic acid. But it frequently happens that a portion of the other metals remains confined in the stannic acid, and escapes the action of the nitric acid. To obviate this inconvenience, the author recommends the following process:—The alloy, without being reduced to a very fine state of division, is dissolved in weak *aqua regia*, and carbonate of soda is added to the dilute solution, to precipitate the metallic oxides; the liquid is boiled with the precipitate for some time. The liquid is afterwards acidulated with nitric acid, and digested at a gentle heat for several hours until the insoluble stannic acid is perfectly white.

The stannic acid thus obtained is always entirely free from copper; but it may still retain a trace of iron, so small, however, that in most cases it may be neglected. To get rid of it, it is necessary to dissolve the oxide of tin in hydrochloric acid, and to precipitate the tin by sulphuretted hydrogen, &c. The oxide of tin, which is obtained by treating directly alloys of tin with nitric acid, is likewise ferruginous.

SEPARATION OF NICKEL AND ZINC.

The separation of these two metals, which occur together in several alloys used in the arts, is of considerable difficulty. All the methods hitherto proposed for this purpose are either exceedingly tedious or very imperfect. M. Brunner states that their separation may be accurately effected by the following method, which is based on the fact that dilute hydrochloric acid has no action on sulphuret of nickel prepared in the dry way, whilst it readily dissolves sulphuret of zinc. The zinc and nickel are threfore precipitated simultaneously by carbonate of soda, the precipitate collected on a filter, dried and feeby calcined, then mixed with 1½ time its weight of sulphur and ⅔ths its weight of carbonate of soda, and this mixture is heated for about half an hour in a small glass matrass at as high a temperature as the glass will bear. The substance is then treated several times with hydrochloric acid diluted with 10 times its weight of water, until no more zinc is dissolved, which is ascertained by testing the liquid, after each treatment with carbonate of soda. The residue of sulphuret of nickel is then dissolved in *aqua regia*, and we have now only to precipitate the zinc and the nickel by carbonate of soda from their separate solutions.

When the alloy contains iron, if it has not been previously separated by ammonia from the nickel and zinc, it redissolves completely with the zinc in the process just described.

ON SCHMIDT'S METHOD OF ESTIMATING NITROGEN.*

BY J. B. BUNCE.

Chemists engaged in organic analysis have long felt the want of a quick and accurate process for the determination of nitrogen. Several objections may be offered to the method of Messrs. Will and Varrentrapp, in following which the substance to be analysed is burned in contact with soda-lime; the ammonia formed is passed

* With chloride of platinum, potassa and litmus, potassa and hydrochloric acid.

† *Bibliothèque Universelle*, April 1851.

* Silliman's *Journal*, May 1851.

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into a solution of hydrochloric acid gas, and after evaporation precipitated as ammonio-chloride of platinum. The more important of these arises from the solubility of the platinum salt, and the time required for the evaporation, drying, weighing, &c. In Liebig's Report for 1847 and 1848, mention is made of several new methods for the determination of nitrogen. Of these, that of Schmidt attracted my attention, and I was led to make some experiments upon it. He burns the substance as in the Will and Varrentrapp process, and passes the ammonia formed into a solution of 1 part chloride of barium in 8 parts of water; then through this a constant stream of carbonic acid is passed, and from the precipitated carbonate of baryta the nitrogen in the analysed substance is calculated by equivalents. In experimenting on this process, I burned carefully-crystallised ferrocyanide of potassium, which had been proved pure by previous experiment; and I obtained results differing so widely from each other, that I was led to suspect some serious difficulty in the process. It was found upon trial that carbonate of baryta was partially decomposed by boiling with chloride of ammonium in a neutral solution, and also that chloride of ammonium when boiled by itself is converted into an acid salt. This holds true with many of the salts of ammonia with the stronger acids. A solution of chloride of calcium in alcohol produced no better results. The precipitated carbonate of lime was decomposed by the chloride of ammonium formed even in presence of alcohol.

I then tried some of the organic salts. Succinic acid gives with chloride of barium no precipitate; but upon the addition of ammonia, a fine crystalline precipitate is produced, only slightly soluble in water, and insoluble in alcohol. But as succinate of baryta is slightly soluble in ammoniacal salts, it was found that no use could be made of this method.

It would appear, therefore, that none of these modifications are capable of affording accurate results, and that the original process by Schmidt, unless some very essential feature is omitted in our account of it, must be considered faulty.

ON A RECENTLY DISCOVERED MASS OF METEORIC IRON.*

BY G. ROSE.

In 1850, during the leveling of a sandy hill for the railroad on the left bank of the blackwater near Schwetz, on the Vistula, a mass of iron was found at about four feet beneath the surface of the soil at the junction of the upper sand with the subjacent loam. The mass of iron was somewhat fissured, and a small portion could be broken off without difficulty, which, to ascertain that it consisted of iron, was forged. The rest was cleft into pieces at Schwetz. After the mass had been recognised as meteoric iron, the whole was sent to Berlin. The separate portions, when rearranged, still exhibited the original form of the mass, which is somewhat that of a rectangular prism, completely rounded off at the edges. The height of this prism was about 9 Prussian inches, the sides of the base 5½ and 4 inches, the longitudinal circumference 24 inches, and the breadth 17¼ inches. A fissure which traversed the fragments runs nearly parallel to a plane, passing through the diagonally opposite longest edges of the base. The weight of the entire mass was 49lbs. 4 oz.

The outer sides of the fragments are rounded and coated with hydrated oxide of iron; the internal surfaces, which formed the surfaces of old fissures, were also oxidised; but in parts the fracture was jagged. One of the surfaces of section has been polished and etched, and now exhibits very beautiful Widmannstattean figures, which have the closest possible resemblance to those of the meteoric iron of Texas. It also shows numerous large and small intermixed grains of sulphuret of iron, which during the corrosion gave off the odor of sulphuretted hydrogen. Some chemical experiments made by the author have proved that it contains nickel: the exact composition will be yielded by its analysis, which Rammelsberg has undertaken.

* *Bericht. d. Wissench. zu Berlin*, 1851.

RESEARCHES ON THE VARIETIES WHICH FAT PRESENTS IN DIFFERENT REGIONS OF THE BODY OF DOMESTIC ANIMALS.*

BY M. J. LASSAIGNE.

It has long been known that the fatty matters extracted from animals present differences in their physical aspect, according to the different parts of the animal system in which they occur; but no comparative work has yet been undertaken with the view of ascertaining whether these differences occur in the same animals. To

* *Journal de Chimie Médicale*, May, 1851.

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fulfil a wish expressed to us by a learned agricultural writer, M. Ysasi, we have commenced the following observations.

In this work we proposed to determine by immediate analysis, what were the proportions of stearine and oleine contained in the fat taken from different parts of the body of the same animal, but experience has shown us that it was not possible to arrive at very accurate results. It is known, indeed, from M. Chevreul's researches, that the separation of these two principles is at least difficult and incomplete, so that, in his work published in 1823, he does not make mention of the proportions in which the fats of animals are formed of them.

If the experiments which we have tried by treating melted fat with sulphuric ether, have not given as complete results as we could have desired, the products which we have obtained, in equal conditions, allow of our establishing a comparison between them.

In the study of the physical property of fats, we have taken into consideration their point of fusion, as presenting a character which should be in relation to the proportions of stearine and oleine of which they consist. The table which we have drawn up to this effect corroborates the results which we have a right to deduce from the quantities of stearine separated from each of the fats by means of ether.

The process we employed was of easy execution; it consisted in melting the fat to be examined, at a gentle heat, in a flask, and in pouring into it twice its bulk of pure sulphuric ether, which dissolves it entirely with the aid of agitation. On abandoning the corked flask to slow cooling, a portion of stearine separated. After 24 hours, the stearine, which was deposited in small, white needles, was collected on blotting paper, and pressed between several folds of the same paper; the dried stearine was detached under the form of small white plates. In this separation, it is important to separate at the same temperature, in making comparative experiments on fats extracted from the same animals, for the solubility of stearine in ether varies greatly with the temperature. It was by experimenting with these precautions that we obtained the results which we give further on.

The points of fusion of the various fats which form the subject of this work was determined as accurately as possible, by placing a thermometer graduated on the stem in each liquified fat, and observing the moment of congelation with care.

With regard to the fat of the horse, which occurs at the temperature of 59° F., under the form of a more or less fluid fixed oil, and a portion of the oleine of which floats over the deposit of stearine, we have thought it right to determine their proportion in volume in equal conditions of temperature.

TABLE REPRESENTING THE POINTS OF FUSION AND THE PROPORTIONS OF STEARINE EXTRACTED FROM THE SAME WEIGHT OF FAT OF THE BULL, THE OX, THE PIG, AND THE HORSE.

Kind of animal.	Part from which the fat was taken.	Color and consistence of the fat.	Point of fusion.	Proportion of stearine extracted from 100 parts of fat.
Bull (2 years.	Kidneys.	Yellowish white; firm consistence.	106° F.	32·0
	Shoulder.	White; less consistent.	97° F.	13·5
Ox, (7 years) killed by a butcher.	Mesentery.	White; solid.	98° F.	18·0
	Kidneys.	*id.* *id.*	87° F.	10·0
	Buttocks.	Yellowish; very soft	71° F.	2·0
Pig, (1 year) killed by a butcher.	Mesentery.	White.	85° F.	4·8
	Kidneys.	*id.*	80° F.	4·5
	Lard under the [skin.	*id.*; very soft.	74° F.	2·0
				Proportion of the congealed part to the fluid part.
Healthy horse, death caused by asphyxia during a fire.	Mesentery.	Yellowish; semifluid.	54° F.	62·1 : 37·9
	Kidneys.	*id.*; less fluid.	65° F.	93 : 7
	Under the ribs.	*id.*; more fluid.	64° F.	90 : 10

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From the facts related in this note, it results:—

1. That the fat of the same animal has not the same composition in the various regions of the economy where it is deposited.

2. That the proportions of stearine and oleine differ in the same fat.

3. That the melting point of fatty bodies extracted from animals, is in general higher in those which are collected from the region of the deeper organs.

4. That the quantity of stearine separated by the action of solvents are in the inverse proportion of the fusibility of these fats.

ON THE QUANTITATIVE ESTIMATION OF MANGANESE.*

BY MR. RICHARD LAMING.

PERHAPS the following facts may facilitate the quantitative estimation of manganese. I find, contrary to what is stated in works on chemical analysis, that carbonate of manganese is not decomposable at ordinary temperatures by the oxygen of the atmosphere, but remains permanently white if it have been precipitated without an excess of carbonate of potassa or carbonate of soda. When an excess of either of these reagents is used in its precipitation, the excess of the alkali decomposes a portion of the metallic carbonate, and becomes a portion of the sesqui- or a bicarbonate. If a bicarbonate of the alkali be used to precipitate carbonate of manganese, the precipitant may be added in excess and the precipitate exposed to the air with impunity. Manganese resembles the magnesian class of metals in its carbonate being undecomposable by caustic ammonia; hence either of the carbonates of the volatile alkali may be used with effect to precipitate a carbonate of manganese that will remain persistent in the atmosphere. Carbonate of manganese, when exposed to any high temperature approaching near to redness, passes at once into the black oxide without apparently going through any intermediate state of oxidation.

MODE OF DETECTING OIL OF TURPENTINE IN PETROLEUM.†

M. SALADIN states that when petroleum containing oil of turpentine is triturated with iodide of potassium and water, it immediately acquires a yellow color, and when the quantity of oil of turpentine is large, an orange tint. One-thirtieth of oil of turpentine can be detected in this manner.

MODE OF DISTINGUISHING ARTIFICIAL FROM NATURAL CAMPHOR.*

BY MR. J. W. BAILEY.

BY the application of polarized light, the smallest portion of natural camphor may be distinguished from the artificial camphor (chlorohydrate of camphene.) If small fragments of each be placed separately on glass slides, and a drop of alcohol added to each, they dissolve and speedily recrystallize. If the crystallization of the natural camphor is watched by means of the microscope and polarized light, a most beautiful display of *colored* crystals is seen, while with the artificial product nothing of the kind is witnessed.

ANTIPUTRIFACTION PROPERTY & PHYSIOLOGICAL ACTION OF PICRIC ACID, NICOTINE, OPIUM, QUININE, THE COMPOUNDS OF STRYCHNIA, &c. THERAPEUTICAL APPLICATION OF THE AGENTS WHICH PRESERVE FROM SLOW COMBUSTION, NOTWITHSTANDING THE PRESENCE OF HUMID OXYGEN.†

BY M. ROBIN.

PICRIC ACID.

CONSIDERING that this acid combines directly with silk, wool and skin, and that in these combinations it enters in sufficient proportion to communicate its color, I have thought that it might also be combined with the various animal matters. And since, as is shown in a remarkable manner by the compounds of tannic acid with the various tissues, these kinds of products, even when they result from the union of two kinds of organic matters, are habitually less attackable by humid oxygen than the free tissues; I presumed that, by combining with organised matters, picric acid might protect them from slow combustion, and, consequently, from putrifaction; and this, in fact, is the case.

In my opinion, picric acid administered to animals during life in a small dose, will be a sedative of the nervous system, an antiphlogistic of great power, in sufficiently

* *Philosophical Magazine.*
† Silliman's *Journal*, May 1851.

* *Polytech. Blatt.*, No. xx.
† *Comptes Rendus*, No. 20, May 19, 1851.

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high dose, a poison causing death by asphyxia.

ORGANIC ALKALOIDS.

The chemical and physiological analogies presented between the hydrocarbon compounds have led me to think that several organic alkalis should act in the circulation, either by themselves or by the products of their decomposition, the part of protecting agents against slow combustion; that, by this mode of action, they are capable of causing death when given in large quantity, and in smaller doses diminishing the vital force—sedation, stupefaction and anæsthesia.

The organic alkalis form two quite distinct groups, those which do and those which do not contain oxygen; I have studied each of these groups in detail.

THE NON-OXYGENOUS VEGETABLES. ALKALIES.

I have made few experiments on these alkalis; but already, from the note which I presented concerning nicotine, (see Comptes Rendus de l'Academie, vol. xxxii., page 177), it is perceived that my anticipations are perfectly realised. I will add that nicotine is also opposed, and with much intensity, to the lactic fermentation.

OXYGENOUS VEGETABLE ALKALIES.

The oxygenous vegetable alkalis differ greatly from the type of the volatile hydrocarbon compounds.; nevertheless, the general solvent power and the physiological properties still manifest an evident kindred among all its compounds: the alkalis of this group seem to be partly waxes, resins rendered basic by the presence of ammonia in their composition. The analogy appeared to me sufficiently great for their antiputrifactive power to be interesting to study.

QUININE AND ITS COMPOUMDS.

It was known that cinchona retards the putrifaction of animal substances, but as it contains a very great quantity of tannic acid, a powerful preserving agent of preservation, no notice has been taken of the part performed by quinine in the phenomenon. The knowledge of this part being of great importance for therapeutical applications, I experimented on the quinine itself and on the saline compounds which it produces. Quinine and its soluble compounds are antiputrifactive; their power increases with their solubility; the basic sulphate is the least soluble, and the least active: the quinine, which is more soluble, is also more active; and the acid sulphate, which is still more soluble, is still much more active.

STRYCHNIA AND ITS COMPOUNDS.

To the agents of the class of oxygenous vegetable alkalis, whose antiputrifactive property I noticed in my sealed packet, of the 29th April, 1851, I added, besides quinine of which I have just been speaking, strychnia and its compounds.

Strychnia requires 6667 parts of cold water to dissolve it; this solution, which then does not contain $\frac{1}{6666}$ of strychnia, exerts no very considerable antiputrifactive power; on the contrary, the nitrate of strychnia, a very soluble salt, possesses, as I have ascertained by experiment, a very evident antiputrifactive power. I have experimented, but more recently, with hydrochlorate of strychnia, a very soluble salt. It is also antiputrifactive, but perhaps less active than the nitrate.

OPIUM AND COMPOUNDS OF MORPHIA.

Smyrna opium, rasped, then agitated in ordinary filtered water and left in the liquor, at the bottom of the vessel, gives a solution which powerfully retards the putrifaction of animal matters immmersed in it.

The sulphate and acetate of morphia, tested comparatively, presented only a very feeble antiputrifactive power.

ON THE VOLATILITY OF PHOSPHORIC ACID IN ACID SOLUTIONS.*

BY J. B. BUNCE.

ROSE, in a paper upon the determination of phosphoric acid, mentions the volatility of this acid with the vapor of water when evaporated in an acid solution. The object of the following experiments was to ascertain the extent of loss which would be suffered in analysis in consequence of this volatility. With this object in view, 0·544 grm. of phosphate of soda were dissolved in a gill of water; hydrochloric acid was then added, and the whole evaporated in a water-bath to dryness, being afterwards heated gently to drive off any excess of acid. The residue was treated with strong sulphuric acid, and allowed to stand several hours in order to convert the pyrophosphate of soda into the ordinary tribasic salt. It was then diluted carefully, neutralized by ammonia, and precipitated as ammoniophosphate of magnesia; the weight of this salt after ignition was 0·701 grm., equal to 0·045 of phosphoric acid. The consequent loss of phosphoric acid in this experiment was 58·66 per cent. Another experiment,

* Silliman's *Journal*, May 1851.

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in which the chlorine instead of the phosphoric acid was determined, gives as the loss of acid 53·36 per cent.

0·2 grm. of phosphate of magnesia and ammonia were next taken, dissolved in hydrochloric acid, diluted until about a gill of fluid was obtained, and the whole was then evaporated as before; after precipitation and ignition, the residue weighed 0·1316, corresponding to 41·69 per cent. of phosphoric acid. The per centage of phosphoric acid in the ammonio-phosphate of magnesia, as determined by ignition, was 48·37 per cent. Consequent loss of phosphoric acid 6·67 per cent.

Another experiment, conducted in the same manner, with the exception that the pyrophosphate of magnesia was converted into the tribasic condition by fusion with carbonate of soda, gave, 8·35 per cent. as the loss. The loss of phosphoric acid, when the solution was acidified with sulphuric acid instead of hydrochloric acid, was greater, probably owing to the higher degree of heat required to volatilise that acid. There was no perceptible difference between the action of hydrochloric and nitric acids. Phosphate of soda was completely converted into the sulphate of the same by three evaporations with sulphuric acid and water. Phosphates of alumina, iron, lime and magnesia were not perfectly converted into sulphates even by a dozen successive evaporations. Phosporic acid does not seem to be more volatile in the vapor of alcohol than in that of water.

These experiments serve to show that the ordinary methods of analysis are not applicable to the analysis of phosphates which must be dissolved in acid by the aid of heat. In the ordinary evaporations to separate silica by rendering it insoluble, a very considerable loss of this acid is occasioned. The estimated quantity of phosphoric acid in ashes, &c. must probably in many cases be much too low, owing to this loss from volatilisation; and we may believe that for this reason many analyses must be regarded as almost valueless with respect to the amount of phosphoric acid which they indicate.

ON SCHONBEINS OZONE.*

BY PROFESSOR FARADAY.

PROFESSOR FARADAY commenced by stating, that considerable mystery was attached to the subject which he proposed to bring before the members on the present occasion—namely, *Ozone*. This name had been given by Schönbein, of Basle, to a substance or condition of matter which manifested itself under very peculiar and widely different circumstances. Schönbein regarded it as an independent body, and a constituent of the atmosphere; but in his (Professor Faraday's) opinion, it was nothing more than an allotropic condition of oxygen. It was never manifested except where oxygen was present, and where, at the same time, water, in a liquid or vaporous condition, was found. No substance had ever been separated from the atmosphere where ozone existed; but its presence was manifested, not merely by the strong smell peculiar to it, but by certain well-marked chemical properties which the atmosphere containing it, possessed.

When electricity is produced from a powerful machine, and allowed to be discharged by a point, there is a feeling of a current or aura as of vapor escaping, and at the same time a remarkable odor. If, during the passage of the electricity, a piece of paper, moistened with a solution of iodide of potassium and starch, be brought near, the discharge causes the production of blue iodide of farina. The blue color thus produced is the result of the oxidation of the potassium by the *ozone*, and the setting free of the iodine. This is one of the best tests for the presence of ozone. It was formerly supposed that nitric acid was produced by the discharge of the spark, and that the decomposition of the iodide was occasioned by this acid as a result of the union of oxygen with nitrogen in the air; but this theory will not account for the smell and other properties of this extraordinary agent.

Schönbein produces ozone in very large quantities by introducing into capacious bottles, with glass stoppers, pieces of cut and cleanly scraped phosphorus, with a small quantity of water, so that the phosphorus may be partly in and partly out of the liquid. A vapor slowly rises in a current. After ten or twelve minutes the ozone is produced, and may be procured in a mixture with oxygen and nitrogen by removing the phosphorus at a water-bath, and thoroughly washing the interior of the bottle with water, in which ozone is insoluble. This body is thus separated from the vapor of phosphorus and phosphorous acid. (This experiment was performed in three bottles, and several bottles of ozone previously prepared were now brought forward.) On introducing paper, wetted with starch and iodide of potassium, into one of the bottles, there was an immediate indi-

* *Medical Gazette.*

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cation of the presence of this principle, by the production of a dark blue iodide of starch. Another remarkable property possessed by ozone was seen in its bleaching powers. Some ounces of a solution of sulphate of indigo were gradually poured into a bottle containing ozone, and shaken, when the color was as completely destroyed as if chlorine or chloride of lime had been present. A very small quantity of ozone would thus entirely discharge the color of a very large quantity of sulphate of indigo.

It has been already stated to be so little soluble in water, that a bottle containing it may be repeatedly rinsed with water without losing its ozonic contents. If, however, the stopper be removed, and it is exposed to air, it soon passes off. Ozone appears to be entirely destroyed by heat; or, at any rate, its production by electricity ceases when sparks are received from a red-hot metallic point. This fact was ingeniously illustrated by insulating a small galvanic battery, capable of raising at pleasure a platina ball to full redness: the battery was made part of the machine, and the platina ball the terminal point from which the discharges of electricity were received. The machine was set to work, and it was clearly and distinctly proved by Professor Faraday that the discharges from the red-hot platina ball produced neither the aura, the smell, nor the decomposing effects on iodide of potassium and starch, which were immediately manifested when the ball was allowed to cool, and the electric fluid was then passed through it.

The oxidising properties of ozone are indicated upon metals which in practice it is rather difficult to convert to oxides—namely, silver. A piece of polished silver had been placed in a bottle of ozone for several hours, and had acquired a distinctly brown tarnish, not from sulphur, but from a process of ozonation, or, in other words, oxidation. Polished lead similarly treated was also oxidised. Ozone had always a tendency to bring metals and metallic oxides to their highest degree of oxidation. In this respect it was the most powerful oxidiser that was known. A tube containing several rings of metallic arsenic had been placed for a short time in a bottle of ozone. The metal had entirely disappeared, and had become transformed into arsenic acid. Paper wetted with a solution of proto-sulphate of manganese was introduced into a bottle of freshly prepared ozone, and in the course of a short time black spots appeared over the surface, proving that the manganese had passed to a higher degree of oxidation.

Nitrogen and sulphur are easily oxidised by it. Schönbein succeeded in procuring a quantity of nitre (of which a crystallised specimen was shown) by the agency of ozone in contact with nitrogen (of air) and potassa. Sulphur was also converted to sulphuric acid. Paper stained with sulphuret of lead was immediately bleached when exposed to an ozonic atmosphere. Some curious experiments of Schönbein's were now shown, in which portraits and inscriptions were seen in white letters on a dark ground, as a result of placing stencilled metallic plates on paper which had been exposed to light and air, or *insolated*. The result was that in these spots the sulphuret of lead had entirely disappeared, having been converted to colorless sulphate of lead by the oxidising action of ozone.

The alleged bleaching properties of solar light on colored articles are thus probably due to the agency of ozone,—in other words, to a process of oxidation and alteration of the color.*

Sulphuretted hydrogen, phosphuretted hydrogen, and all foul effluvia, are speedily oxidised and destroyed by ozone. It is, therefore, the great purifier of the air; and, owing to its continual exhaustion by oxidating processes, it is difficult to discover the presence of ozone in large and populous places, or in close and crowded dwellings. In the open air of the country, and on the sea, it constantly exists in a proportion which is probably subject to great variation, although ruled by laws which are at present unknown. Schönbein had contrived an *Ozonometer* for testing the amount contained in air. It is prepared by immersing paper in a solution made of one grain of iodide of potassium, ten grains of starch, and two hundred grains of water. The paper is dried, and, when intended for use, is exposed for some time to the air. There is no change until it is wetted with water, when, if ozone was present in air to which it had been exposed, a blue color will appear, the intensity of which varies according to the quantity of ozone present and the length of exposure. The ozonometer consists of a series of papers thus colored in different degrees, and bears some

* This hypothesis should have its correctness tested by the exposure of colors known to fade, in hermetically sealed tubes. Oils, it is well known, are bleached in close bottles; but they may contain air, and wherever there is air there is ozone, a very small portion of which possesses remarkable powers of bleaching.

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analogy to the cyanometer long since proposed by Humboldt.

Professor Faraday stated that, during the last autumn, when at Brighton, while walking close to the sea-shore, he exposed some strips of this prepared paper to the current of air coming over the sea, and, on subsequently wetting the paper, the presence of ozone was distinctly manifested by the blue color produced. On another occasion he received on the same paper the current of air blowing over the town, but no trace of ozone could be detected in it. When he went, however, on the windward side of brighton, so as to catch the air blowing over the downs before it reached the town, ozone was strongly manifested by the result. It was thus established that in populous places there is a constant consumption of this principle.

It had been shown that ozone was evolved with the ordinary electricity of the machine; it was now proved that the current of the battery equally leads to its production. Water was decomposed by a Grove's battery, and the oxygen and hydrogen evolved were conducted through a tube in which cotton soaked in potassa had been placed to arrest any traces of acid. The gases evolved at the end of the tube decomposed the iodide of potassium on starch paper, and gave the usual indication of the presence of ozone.

Ozone is evolved in numerous chemical processes. If pure ether, mixed with water, be introduced into a wide-mouthed capacious bottle, and the vapor allowed to become diffused, it will be found that litmus paper introduced is not reddened, and that starch paper prepared with iodide of potassium is not rendered blue. If, however, a glass rod be made hot in the flame of a spirit-lamp, and then introduced into the vapor of the bottle, litmus paper held above the rod becomes strongly reddened, and the iodide of potassium paper intensely blue. In the oxidation of ether vapor at a low temperature, ozone is evolved.

Ether, in its ordinary state, has no bleaching properties; but the ether thus treated had acquired the power of discharging the color from a large quantity of sulphate of indigo.

Essential oils are thickened by long exposure to light and air; they become ozonised and their properties changed. This was illustrated by reference to oil of turpentine. Freshly rectified and pure oil of turpentine was proved, by admixture with sulphate of indigo, to have no bleaching power. A small quantity of oil, which had been exposed to air and light (the air in a bottle half full), destroyed the color in a few minutes, like chlorine.

We cannot doubt that ozone exerts an important influence on the atmosphere, and, therefore, on the health of animals and vegetables. Schönbein, who is rather sanguine in his views, considers, from the irritant properties of ozone, that an undue proportion of it in air may give rise to epidemic influenza, bronchitis, and other affections of the air-passages; and, in making experiments at Basle, he found that, concurrently with the prevalence of these disorders, ozone was very abundant in the air. On the other hand, it has been said that its deficiency in air will account for cholera or fevers, since the foul effluvia or miasmata giving rise to these diseases are not completely destroyed or removed by the oxidising action of ozone. These, of course, are mere speculations insusceptible of proof; but, in the meantime, it must be conceded that the subject opens a new road to experiment and observation, and that very important results may be obtained by following out Schönbein's researches.

[It would be difficult to describe the intense interest which this lecture excited in a large and crowded auditory. The illustrative experiments were most ingeniously contrived, and were remarkable for their novelty. The conclusions of the lecturer were fully justified by the results.

We think Mr. Faraday has afforded the right explanation in assigning the properties of ozone to an allotropic condition of oxygen. This extraordinary element, which forms by weight one-fifth of the atmosphere, eight-ninths of water, and one-half of the solid crust of the earth, may, like other supposed elements, be capable of existing in two states (allotropic) so widely differing from each other as to possess nothing in common excepting the name. Phosphorus presents this allotropic condition: in its ordinary state it is colorless, luminous in air in the dark, forming a deliquescent acid, is soluble in bisulphuret of carbon, and melts and burns at a very low temperature, about 108°. If phosphorus be kept for a time at a temperature between 464° and 482°, its properties are entirely changed: it acquires a brownish-red color on cooling; it requires a high temperature for combustion: so that, unlike common phosphorus, it may be safely handled and carried in the pocket: it does not deliquesce in moist air, and is quite insoluble in bisulphuret of carbon. Liebig states that, while common phosphorus is

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poisonous, the altered phosphorus has no action on dogs. At a low red heat, the altered phosphorus is reconverted to and requires all the properties of ordinary phosphorus! There is, therefore, no apparent change of matter, but merely a change of state.

Thus Mr. Faraday considers that oxygen bears the same relation to ozone that ordinary does to altered phosphorus,—that they may, under certain conditions, pass and repass into each other; but what those conditions are which produce and *regulate* the conversion of oxygen into ozone in the atmosphere it is impossible to say. Chemical agency, electricity and magnetism, may be the constant sources of production. Decay, disease, and death, affecting alike animals and plants, may be the means by which ozone or allotropic oxygen is consumed; but what power is it that *regulates* the quantity produced, and so adjusts it that it shall conduce to health and life? This is a profound mystery. It is obvious from what is already known, that by an over-conversion of oxygen in the atmosphere into this allotropic condition, every living being would perish; and it is not improbable that the arterialisation of blood may be due, not to oxygen in its ordinary, but in its allotropic state. It is commonly said that oxygen is absorbed as such, and the red corpuscles of blood are regarded as oxygen-carriers; but the researches of Schönbein open a new path of research for physiologists.

It has been a mystery whence those sulphates and nitrates are derived, which are frequently found in freshly collected rain water that has only washed the atmosphere. Ozone may be the agent by which the sulphur-gases and ammonia that are diffused in the atmosphere become oxidised and transformed into acids and salts. Acid springs, which are found in some parts of the world, and the great nitre beds of Ceylon, and on the coast of Peru, may owe their origin to this allotropic influence in past ages, and still working slowly at the present time. Although ozone does not appear to be dissolved by water, it is a question whether the oxygen in that liquid may not assume an ozonic condition, and thus accouut for the rapid conversion of nitrogen, sulphur, and phosphorus, or the compounds containing them, to nitrates, sulphates, and phosphates. Every chemist knows the rapidity with which sulphuretted hydrogen is decomposed in all kinds of water exposed to air:—sulphur is precipitated, or, if a base be present, acidified, and a salt formed. Oxygen, therefore, either in its ordinary or allotropic state, is the great purifier of air and water.

Oxygen in combination may be frequently in the ozonic state, or may become so during its evolution. Chromic acid not only bleaches, but sets free iodine from iodide of potassium. Peroxide of hydrogen and other hyperoxides have a similar action. Chlorine and bromine resemble ozone in their bleaching powers, and in their action on iodide of potassium. The bleaching is commonly referred to *nascent* oxygen, because dry chlorine has no such effect; but for the term nascent we may now, perhaps, be justified in substituting the word *allotropic*, and refer the effects to the ozonic condition of oxygen.

The oxidation of the metallic sulphurets by ozone throws a curious light on the probable cause of the destruction of photographic drawings. If any sulphuret of silver be left in the finished drawing, the drawing is slowly bleached, and the sulphuret converted into sulphate of silver. In drawings which have been framed the change is observed to commence on the external margin, and slowly spread to the centre. There are many other remarkable chemical changes which will now probably receive a more satisfactory explanation than has been hitherto assigned to them.—Ed. Med. Gaz.]

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II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

ON THE USE OF COMMON SALT IN AGRICULTURE.*

BY PROFESSOR WAY.

Mr. Way commenced his lecture by adverting to the circumstances under which it was given. A few weeks ago, at a meeting of the Society, one of its members, Baron Mertens, expressed the desire of his (the Belgian) Government, to elicit from English agriculturists, their experience with regard to the use of salt; and at the suggestion of Mr. Fisher Hobbs and other gentlemen, it was arranged that it should form the subject of a lecture to be delivered by the chemist of the Society. He (Mr. Way) had great pleasure in appearing before the Society, in accordance with their request, but they must not expect him to bring before them anything particularly novel on the subject. The question had been repeatedly discussed by able men in lectures, books, and special essays, particularly at the period when the removal of the duty on salt was contemplated and effected; and more recently, when a like measure was proposed by the French Government. To reopen the question in detail would require not one, but several lectures, and he considered that, under the circumstances, the wishes of the Society would be best carried out if he simply recapitulated the various conditions in which salt had or had not been beneficial as a manure, and the no less various opinions which were held as to its mode of action. It was with the last that his business chiefly lay, and in reviewing them he should pass rapidly over those which were open and palpable, and give his chief attention to those others which, from their obscurity, were more worthy of investigation. Mr. Way should endeavor to compress what he had to say into the space of half an hour, in order that those whose practical experience it was so important to obtain might have an opportunity of communicating it to the Society.

1. That common salt improved the weight and quality per bushel of the grain of wheat, barley, and oats.

2. That it strengthens the straw of these cereal crops.

3. That it increases the crop and improves the quality of swedes, turnips, and carrots, and still more of mangold wurzel.

4. That it improves the quality of the grass in heathy pastures, and makes it more palateable to stock.

5. That it kills wireworms and slugs, and destroys noxious weeds.

6. That it promotes the health of animals when given with their food. Common salt has also been found beneficial to potatoes, peas, &c., but not so commonly as the other crops mentioned.

Now, in order to establish the fact of the beneficial action of salt, it was not necessary, in Mr. Way's opinion, that every person should have obtained a similar result; nor was it necessary even that a multitude of instances of success should be adduced. One experiment, intelligently carried out and truthfully reported, was sufficient to prove that salt has, in certain conditions, a beneficial effect upon crops. On the whole, numerous may have been the cases of failure (and it is to be remembered that failure is less often reported than success), it must be allowed that there was ample evidence to prove that common salt exercises some influence on vegetation, and it was worthy of observation that when employed in moderate doses, this influence has rarely been found to be noxious or prejudicial. The question then was as to the nature of that influence: that salt kills wireworms and slugs if a fact, is a fact that needs no demonstration or discussion; that it destroys weeds is of the same kind, other plants equally suffering from its effects when used in excess. But in what way does it improve the quality of wheat? in what way strengthen the straw of corn crops? of what nature is its influence upon turnips and mangold wurzel? these are the points that demand the attention and investigation of science.

Now the advocates of common salt have been in the habit of explaining its action by reference to many different properties. They have called it a stimulant to plants. This is in reality no kind of explanation, but only the assertion of the fact. Common salt is observed to cause an increased and energetic vegetation, and it is therefore said to stimulate; but how it brings about this result we are not told. The property of salt of attracting moisture had also been referred to as

* Royal Agricultural Society of England.

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accounting for its action. There was no doubt that salt did increase the proportion of moisture in the soil, but to a very small extent. Mr. Way had made a calculation by which he found that 20 bushels of salt applied to an acre of land, would, if it attracted water till it was entirely dissolved, add only half a per cent. of moisture to that already present in the soil. An experiment made by Mr. Cuthbert Johnson, and quoted by him in his excellent essay on the use of salt, as proving the increased absorption of moisture caused by salt, only showed that this effect was really insignificant. One thousand parts of a dried soil, that by exposure to the air for 18 hours had gained 25 parts of moisture, was found by Mr. Johnson, when salted at the rate of six bushels an acre to gain 26, and at the rate of 12 bushels, 27 parts of moisture in the same time. Mr. Way did not think that the property of salt to attract and retain moisture went far to explain its beneficial result on land, and the same was true in a lesser degree of muriate of lime or any other deliquescent salt which it might give rise to in the soil. Then it has been supposed that common salt is a direct food of plants; that is to say, that it is necessary to enable them to build up their organs, in the same way that phosphorus and sulphur are now known to be indispensable elements of vegetation. Were this actually the case, the whole question would be set at rest. Supposing that common salt existed in every kind of vegetable in such definite quantity as to lead to the belief that it was a component part of their organised structure, then plainly its existence in the soil in some shape or other would be absolutely necessary for vegetation; and we could readily understand how its artificial supply would in some instances have the best result; this point, therefore, demanded attention.

The analyses of the ashes of plants had shown, that whilst common salt was present in very large proportion in mangold wurzel, carrots, turnips, and such-like plants, and in lesser, although still considerable, quantities in the grasses and the straw of different corn crops, it was almost, and in some cases entirely, wanting in the seeds of plants. Thus by the table to which he directed their attention they would see that, whilst 1000 lbs. of mangold wurzel contained as much as 37 oz. of salt, the same quantity of wheat furnished only 1 oz.; indeed the last figure was a manifest exaggeration, since in the ash of 26 samples of wheat examined by him, only four cases had occurred in which common salt could be detected at all, and the amount mentioned above was the average of those four cases. This was a very important fact, and one which must be steadily kept in view, in attempting to discover the part played by salt in vegetation. If it was contended that common salt was part of the food of plants (and it must be remembered that in speaking of the food, at all events of the *mineral* food of plants, we could only be guided by what we found in them), then how came it to be absent from the grain of wheat in 22 out of 26 instances?

Mr. Way observed that it was at all times dangerous to generalise to too great an extent, and therefore it might hardly be safe to say that what applied to wheat must also apply to mangold and turnips; that since common salt was not a necessary ingredient of wheat, its existence in such large quantities in mangold was also accidental; but it must be allowed that the nature of the respective plants in some measure justified such a conclusion. The grain of wheat, for instance, contained, when ripe, from 10 to 15 per cent. of water, and 80 or 90 per cent. of dry matter. In the turnip or mangold, on the contrary, the state of things was entirely reversed: in these roots, for 10 or 15 per cent. of dry or vegetable matter, we find from 85 to 90 per cent. of water. It was reasonable to suppose that this water would contain a portion of any soluble salts existing in the soil, and quite evident that from the quantity of water present in the turnip or beet, we must expect to find in these roots a considerable amount of substances having nothing whatever to do with vegetation.

The seeds of plants are, when ripe, individually perfect, which no other parts of plants are. The stems and other solid parts have always in them the unmatured and circulating juices in all states of transformation. On the other hand, in the seed of a plant, every portion seems to become fixed. As the period of final maturation approaches, all substances not actually required for its well-being are excluded and expelled from it. Finding phosphorus and sulphur, magnesia and potassa, in large quantity in the ripened seed, but failing to detect common salt there, we are justified in supposing that the former substances are, and that the latter is not, indispensably necessary as an element of vegetable nutrition.

It remained to be seen whether the presence of common salt in the root crops is to be accounted for on the supposition that it is really an element of their food; but, in the meanwhile, Mr. Way wished to call attention to the circumstance, that, although common salt, as a

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whole, might not constitute any portion of the food of plants, the alkali which it was capable of furnishing might yet be of great importance to vegetation. Common salt is the muriate of soda, that is to say, the alkali soda, combined with muriatic acid. Now, it has been already shown that this compound is not a necessary constituent of the grain of Wheat. In the analyses of Wheat-ash before mentioned, soda was generally detected in small quantity; in comparison, however, with that of potassa, the proportion was so minute as to lead to great doubts whether soda was indispensable to the crop in question. In the root crops soda is frequently found in large quantity in other forms of combination besides that of the muriate; but even here its presence was not constant, for he (Mr. Way) had examined several samples of turnips in which no soda existed beyond that combined with muriatic acid.

Taking these two circumstances together—the entire absence in some cases of common salt from seeds and the equally well-ascertained absence of other salts of this alkali from turnips and other root crops—he was inclined to think that the theory which supposed common salt to be directly or indirectly—either as a whole or as a source of soda—a constituent of the food of plants was not satisfactorily made out.

It only remained, therefore, to examine in what way salt could act as an agent of vegetation. The French had an excellent method of classifying the substances used as manures. With them only those substances were called "manures" which were known to operate by supplying some of the elements requisite for the nutrition of plants; thus ammonia and its salts would be manures as supplying an element (nitrogen), entering into the composition of plants. Those other applications which contribute to improve the texture of the soil, and to bring into play its dormant energies, are known as "amendments" or "improvers." Sand added to a heavy soil would be of the latter class, as would lime, because although it is certainly part of the food of plants, we evidently use it with other views when we apply it in such large doses to our fields.

Salt, then, having failed to prove its claim to be ranked under the first head in the French agricultural vocabulary, it remained to be seen whether it operated as an indirect agent in vegetation. Indeed, granting the efficacy of salt as an application to the soil, this was the only other way of accounting for its effects. It had been said that salt in small doses hastened putrefaction, and that in this manner it was capable of furnishing the growing plant with a more abundant supply of vegetable and animal food. Mr. Way had no personal knowledge of this property of salt, and the assertion did not appear to him to be altogether free from doubt. But at all events it so happened that the soils upon which salt has been most successfully employed; that is to say, the light and open soils, were precisely those in which the decay of manure is very rapid, and in which consequently there would be less necessity for the kind of assistance which salt was considered capable of affording. Although he did not intend to deny the possibility that salt might be beneficial, in consequence of the property imputed to it of decomposing vegetable matter, Mr. Way observed that we must seek some further explanation of its action.

He had now to bring before their notice a property of salt, which, so far as he could learn, was entirely new. When a portion of a soil is shaken up with water, and the mixture allowed to stand till it gets clear or is otherwise rendered so by filtration, the presence of a little lime, in the state of sulphate and other soluble salts, will generally be detected by the proper tests.

If instead of water, a weak solution of common salt was employed, the indication of lime in the liquid would be immeasurably greater than in the other instance. Now if common salt was acted on by soils in the same way as salts of ammonia and potassa—its base, soda, being absorbed by the soil, and lime uniting to the muriatic acid—this dissolving out of lime would be of easy explanation.

Mr. Way had, indeed, on a former occasion, stated that soda was subject to the same law of absorption as the other bases mentioned, but he had at that time made no very definite experiments on this subject. Subsequent investigations had shown him that some soils, at all events, have no power of retaining this alkali, and the soil which he had just used before them was such an one; it did not absorb soda from common salt. How then were they to account for the quantity of lime dissolved? At present he was not in a position to say with authority; but as he had proved to his own satisfaction that it did not arise from the presence of any of the ordinary salts of lime in the soil, he was led to believe that the common salt acted on certain silicates of lime present, in a way as yet not understood; and at the same time as it afforded a supply of lime to plants, gave rise probably to a modification

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of silica important to the straw of the cereals. But leaving out of the question this latter possibility, the mere increase of the quantity of lime in a soluble condition, might itself go far to account for the effects of salt. Our whole system of agriculture was an attempt to heighten and increase the energy of those causes which operate naturally on a smaller scale. The appointed solvent of lime was probably carbonic acid, but it is easy to conceive that the artificial cultivation of certain crops would require more copious supplies of this substance, than could be furnished by the usual methods. Salt may, at this point, step in, and meet the emergency in a way consistent with the functions of the plant, and minister to the artificial wants of the crop in an unusal and artificial manner. Mr. Way was at present following up these experiments, from which he hoped to derive some information.

It would be seen then, that the presence of large quantities of common salt in root and other crops, might be only a secondary result due to this substance, having been executing its office as a solvent, and thus introduced into the juices of the plant.

Having now taken the liberty of adding another theory to the already too large list on the action of common salt, and having expressed his opinion in favor of those views, which held it to be an *agent* rather than an *element* of vegetation, he would leave the further discussion of the question in the hands of the meeting.

PHOTOGRAPHY ON PAPER.—PHOGRAPHIC IMPRESSIONS.*

BY M. BLANQUART-EVRARD.

In my communication to the Academy of the 14th of April, I stated, that in order to bring photography into the position of an industrial art, we must substitute chemical action for the intense action of light; a method which furnishes products both abundant and reasonable in price.

In this point of view, two considerations remain to be fulfilled: 1st. to give to the proofs at pleasure, the most suitable coloring, or that which the purchaser requires; 2d, to restore to a marketable condition, all imperfect proofs: that is to say, those which are either too pale or too dark, in order to prevent loss by unsaleable articles: these results are obtainable by the following means:

Decoloration.—After having been dried, the proofs which have come out of too dark a color, are to be brought to the state of decoloration desired, by immersing them in a water-bath, to which a few drops of bromide of iodine has been added in sufficient quantity to give it a pale-yellow color. The bromide dissolves the photographic image; its gradual action is perceptible to the eye, especially by daylight; the action may be stopped as soon as desired, by dipping the proof in a bath of hyposulphate of soda, which in a few seconds removes the excess of bromide; after which it is washed in a large quantity of water.

Process for increasing color.—In order to deepen the color of proofs which are too pale, they are to be made to imbibe acetic acid. Under the influence of this agent, the paper becomes tough, like parchment, and acquires the transparence of oil-paper. In this state it is immersed in a bath of gallic acid, to which a few drops of nitrate of silver have been added.—The increase in color, of the image, rapidly appears; and the deepest black color may thus be obtained. The action may be arrested at the desired point, by immersing the proof in a bath of hyposulphite of soda; after which it should be washed in a large quantity of water, to remove all traces of the hyposulphite.

The specimens accompanying this communication, show to what a degree of intensity proofs can be brought, of which scarcely a trace appeared on the paper, and yet preserve in the light their primitive clearness. I would take the present opportunity of pointing out the peculiar property of acetic acid, which preserves from coloring by gallic acid, or gallo-nitrate of silver, the parts of the paper which should be kept white; confining the action of those powerful agents to the coloring of the salts of silver, which have been decomposed by the light; whether they are apparent or not at the time of operating. On treating the negative proofs in the same way as we have described for the positive proofs, we are enabled to obtain the deepest shade of color.

The researches above made, have reference to the improvement of old proofs. The negative proofs, immediately after exposure, may be also developed in the same manner: though with less advantage, by adding from 5 to 10 per cent. of acetic acid, to the gallic acid bath. At first appearance, the image presents itself with great uniformity; the white parts are more transparent, and the dark assume a greater intensity. To obtain these results, however, the exposure must not be carried too far; and it will be found necessary to follow

* *Comptes Rendus.*

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the method I pointed out in the year 1847, viz., to immerse the proof entirely in the bath; and not to apply the gallic acid to the surface merely.

It will thus be seen, that if it is possible, at pleasure, to strengthen or diminish the color of old proofs, photography may then take rank amongst the practical and industrial arts.

Before closing this communication I will offer a few remarks on the communication of M. Bayard, lately presented to the Academy.

The author of this communication has laid down a principle, to which too much latitude must not be given, lest it lead us astray. The problem does not appear to us to be absolutely what he says—"to render the positive paper very susceptible of impression, under the action of a relatively very feeble light." In the first place, all the papers prepared with iodine are negative: it is in the employment of these, for positive proofs, that the new method consists. Now it is not when they are very susceptible of impression, that they are fit to give positive proofs; but, on the contrary, when their capability of being reduced is paralysed by an agent, which does not allow it to take place except under the influence of the light. Thus, the more sensitive the iodised papers are, the less perfect are the positive proofs obtained from them. The more the non-reducing agent introduced into the preparation predominates, the more valuable this prepartion becomes, since it enables us to keep, for a much longer period, the papers ready for use.

The preparation which we experimented upon, in April, 1847, before the mixed Commission of the Academy of Sciences, and the Academy of Fine Arts, gives a proof, by means of M. Daguerre's normal object glass, in from fifteen to twenty seconds. The paper thus prepared is, therefore, fifteen times more sensitive than that, the preparation of which has recently been communicated to the Academy; and it is precisely on that account, that it cannot produce a satisfactory positive proof, because the slightest action of the light, or the least delay in the operation, after its preparation, bring about those reductions, which causes the paper to lose all its freshness, when treated with gallic acid.

In a practical point of view, therefore, the value of the preparations hitherto employed, may be reckoned in the inverse order of their sensitiveness, and it is on this account, that we prefer our own preparation to that of M. Bayard; because, being less readily reducible, it is not so liable to alteration.

All the preparations for iodised papers, give a positive proof, by means of the light of a Carcel lamp; and this image is the less perfect, the shorter the time required for its production. Thus, the preparation which I have referred to, gives an image in less than ten minutes, in which time the paper undergoes an entire coloring, by the abundant reductions produced, even at this feeble light, and in so short a time.

Albumen, serum, and acetic acid, are the agents to which we have recourse, in order to obtain the positive proof by chemical action, because these agents tend to diminish the action of the light on the white parts of the paper, which must be preserved free from color, in order to produce agreeable effects; the vapor from hydrochloric acid is preferable, because it enables the papers to retain these qualities for a longer period.

It is therefore by seeking for resisting, and not accelerating agents, that we shall attain that degree of progress, which consists in enabling us to obtain preparations, by the use of which, the paper retains its qualities, not for twenty-four or thirty-six hours merely, but for weeks, and even months. Nor must we fear to render the paper too insensitive, since we find from well authenticated tests, that a paper requiring four or five minutes' exposure to the sun for a negative proof in the camera, gives a positive proof in a single second.

ON A MEANS OF DEFINING AND NAMING COLORS ACCORDING TO A SYSTEMATIC AND PRACTICAL METHOD, AND APPLICATION OF SUCH MEANS TO THE DEFINITION AND DENOMINATION OF THE COLORS OF A GREAT NUMBER OF NATURAL BODIES AND ARTIFICIAL PRODUCTS.*

BY M. CHEVREUL.

M. CHEVREUL, after stating that he had, for a long period, felt the want of a better system of definition of colors than that generally adopted, set himself the task of ascertaining whether or not it was possible to bring all colors into a natural nomenclature, by placing them under types, classified in a manner so simple, as to be accessible to the intelligence of all employed in colors: whether in a scientific point of view, or in their practical application to the arts and manufactures.

* Paris Academy of Sciences.

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A few historical details, says M. Chevreul, will show how I have been led to this result, in following out certain researches, which were not originally undertaken with this view.

A substance of a red, yellow, blue, orange, green, or violet color, can only be modified in four ways, when employed in painting or dyeing:—

1. By white, which, in brightening it, weakens the intensity.

2. By black, which, in making it sombre, diminishes the intensity.

3. By some color which changes without tarnishing it.

4. By some color which changes it by tarnishing; so that, indeed, if the effect be carried to the maximum, the result is either black, or normal grey, or in other terms, black mixed with white.

It is, therefore, to define these modifications, without ambiguity, by means of language free from all doubt, that I have applied the terms *tones of color*, to the different degrees of intensity of which a color is susceptible, whether the substance which presents it be pure, or simply a mixture of black and white—that I have applied the term *gamut* to the *ensemble* of the tones of one color—that I have applied the term *shades* of a color to the modifications of a certain color, without tarnishing it; and lastly, that I have devised the *hemispherico-chromatic arrangement*, of which I have given a drawing and description in my work, on the "*Law of the Simultaneous Contrast of Colors.*"

With the assistance of the talent and perseverance of M. Lebois, the principal foreman in the dyehouse at the Gobelins, I have executed the beautiful arrangement of colors, which I now submit to the notice of the Academy.

Now, each simple or binary color gives 20 tones; 72 colors + 20	1,440
Each simple or binary color giving 9 gamuts of 20 tones lowered by black; 72 + 9 = 648 gamuts, which + 20	12,960
The lowering of the black giving tones	21
We obtain as the total amount of tones of the hemispherico-chromatic arrangement	14,421

The practical application of this method of clearly defining colors will be evident:

First, we can establish a uniform nomenclature of colors, applied to printed tissues or painted surfaces in any way, and thus judge of the arrangement of colors in all those branches of industry which speak to the eye by colors.

Secondly, we can define, in chemistry, the color of all colored substances, with greater accuracy than we can at present.

Thirdly, we can define, in natural history, the colors of living creatures, and thus distinguish those which have undergone no changes from those which do undergo such changes, whether in the same individual at different periods of its existence, or in individuals of the same species. Thus I have satisfactorily proved that the dahlia is susceptible of presenting forty-two colors.

PREMIUM OFFERED FOR IMPROVEMENTS IN PHOTOGRAPHY.

Mr. E. Anthony, of New York City, offers a reward of 500 dollars for the most valuable improvements in photography, which shall be made before the close of the present year. The improvement may be in any branch of the art, or of any nature, and the artists of England, France, and Germany are free to compete for the prize. The following Committee will make the award:—Professor Morse, Professor Draper, of the New York University, and Professor Renwick, of Columbia College.

INCRUSTATIONS IN STEAM BOILERS.*

BY C. W. WRIGHT, M.D., CINCINNATI.

The incrustations which form in the interior of steam-boilers, have given rise to much discussion, and many substances have been recommended for the purpose of obviating a result attended with so much difficulty to the engineer.

Several attempts have been made to deprive water of the saline matter which it holds in solution before it is introduced into the boilers; but these have been without effect, and the main object seems now to be to prevent the incrustations adhering so firmly to the boiler, that their removal will not be attended with much trouble.

Coal-tar was recommended a year or two ago in the *Scientific American*, I believe, as being most effective in preventing these incrustations; but little notice seems to have been taken of it, and potatoes, sugar, &c., were recommended and tried, but did not entirely succeed.

In the city of Louisville, where the water is more highly charged with lime than it

* *Scientific American.*

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is in many other places, this inconvenience is severely felt; there, after a trial of various substances, they find the coal-tar to succeed better than any other article.

The following is the manner of using it: after the boiler has been cleaned, about one pint of the tar is introduced into it, after which it is poured into the heater, and thus reaches the boiler. In Louisville, one pint a week, introduced into the heater, is sufficient for a double-flued boiler 28 feet long.

During the use of this substance the lime is found in the boilers in large flakes, or if not absolutely loose, is removed by the application of the slightest force.

In one establishment this agent has been used for a period of six months, and in another for more than a year.

Coal-tar is a very economical substance for this purpose, especially in cities where gas is manufactured from coal.

ON GILDING PORCELAIN.*

A METHOD of gilding porcelain is at present practised in Paris, which is very economical, as the gold can be applied in very thin layers. The gilding, however, is not very durable. The method consists in precipitating the gold from its solution in aqua regia by protonitrate of mercury, and then mixing it with basic nitrate of bismuth. In other respects the usual proceeding is adopted.

To render the gilding more durable, M. Grenon recommends a layer to be previously burnt in; this is then polished, and a second thin layer applied upon it in the above manner.

ABSTRACT OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.†

Improvements in Refining Steel. (A communication.) EWALD RIEPE, of Finsbury Square, merchant. Patent dated December 5, 1850.

Specification.—I take bars or lumps of raw or crude steel (particularly puddled steel), and in order to the refining of them, place them in a furnace or other heating chamber, out of the reach of any injurious action upon them by the atmospheric air, and there subject them for a time to a temperature not exceeding the melting point of steel. I use for the purpose a welding furnace, such as is ordinarily employed in puddling iron, only that the bed is lowered and the grate brought from two to four feet below the level of the fire-bridge, and the ashpit is provided with an iron door, by which it may be entirely closed when required. When the furnace is in full heat, I place the bars or lumps of raw or crude steel on the bed of the furnace, at distances apart, so that they may nowhere touch each other; and during the whole of the refining process, the fire-place is kept fully charged with coals or other fuel. Then, in order to exclude as much as may be the access of oxygen, I carefully lute any crevices there may be, in the working door or elsewhere, with wet clay, and so regulate the draught of the furnace by means of the ashpit-door and flue-damper—closing them more or less, or altogether, as may be requisite—that the heat shall never attain to the melting-point of steel. A sufficient practical test of this is furnished by the color of the flame, which is, with this view, carefully watched through an eyehole in the working door. As long as it keeps of a dull or hardly red color, the heat will not be in excess of what is required. I usually put from 900 lbs. to 1000 lbs. of raw or crude steel, in bars of 3 inches by 1¼ inches, into a furnace of the ordinary size, and continue the operation for about four hours. By this method of operation, carburetted hydrogen and oxide of carbon are developed in the furnace in abundance, while the oxygen of the atmospheric air is entirely prevented from acting on the steel; and the product is steel of a very fine uniform grain.

And having now described the nature of the said invention, and in what manner the same is to be performed, I declare that I do not restrict myself to the use of any particular form of furnace, nor to the subjection of the crude or raw steel to the refining process in any particular quantities, or of any particular sizes: but that what I claim is the refining of raw or crude steel (particularly puddled steel), by placing it in a furnace or other heating chamber, out of the reach of any injurious action upon it by the atmospheric air, and there subjecting it for a time to a temperature not exceeding the melting point of the steel.

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* *Gewerbe-blatt aus Würtemberg*, 1851, N. 6, pp. 66, 67.

† Collected from *The Mechanics' Magazine*, and *Patent Journal*.

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Improvements in the manufacture of alum and in obtaining ammonia. JAMES THOMSON WILSON, of Stratford-le-Bow, Middlesex, chemist. Patent dated December 7, 1850.

1. Mr. Wilson's process of manufacturing alum consists in subjecting aluminous shales to the direct action of a sufficient quantity of sulphuric acid to saturate at a single operation all the alumina contained in them, and convert it to the state of sulphate, the alum being obtained by subsequent crystallisation in the usual way. The shale should be selected of a kind as free as possible from coal, or iron, lime, and other soluble impurities, and after having been exposed to the air for two or three months, to reduce it to small fragments, and then burned in a lime or other similar kiln, is to be placed in an open boiler, about 15 feet long, 5 feet wide, and 4 feet deep, lined with lead, and having a false bottom at a height of about 15 to 18 inches above the bottom, composed of lead of about 24 lbs. to the square foot, perforated with numerous holes of half an inch diameter, and supported on an iron framework, and provided with suitable conveniences for allowing the bottom of the boiler underneath to be examined and cleaned out. Into this boiler, which is to be placed over a furnace in such a position that the flame does not rise to within a couple of inches of the false bottom, the shale is then deposited, the larger pieces being screened out, and laid immediately on the false bottom, and sulphuric acid of a specific gravity of 1·845, added in the proportion of 10 cwts. to every 12 cwts. of shale, with sufficient water to reduce the specific gravity to 1·35 or 1·4, and nearly fill the boiler. Heat is applied, and a gentle ebullition kept up for eight-and-forty hours, when the whole of the available alumina will have been dissolved, and the solution will be fit to be treated for crystallisation by using sulphate of potassa or ammonia. The patentee has, however, observed that, when alum is at once crystallised from solutions obtained as above described, a certain quantity of the acid in such solution remains in excess, and renders the purification of the alum a matter of difficulty. Now, to obviate this objection, he introduces into the solution either ammoniacal liquors of gas works, or condenses therein vapors containing ammonia which combines with the excess of acid, and renders the solution fit for immediate crystallisation.

Claims.—1. The formation of sulphate of alumina by employing a sufficient quantity of sulphuric acid at a high temperature, and thereby dissolving the whole of the available alumina of the shale operated on at a single operation.

2. The use of the essential construction of boiler and arrangement of materials therein as stated, so as to allow of the application of sufficient heat to cause a thorough circulation of the liquors, and a perfect drainage of the whole of the shale, and thereby obtain the sulphate of alumina without waste of the materials employed.

3. The conversion or sulphate of alumina into alum by adding ammonia thereto, in such a state that it shall combine with the excess of acid contained therein, when obtained from shale by directly dissolving the alumina thereof in dilute sulphuric acid.

2. Mr. Wilson proposes to obtain ammonia by causing the gaseous products from coke ovens and furnaces to ascend through a shaft filled with coke or pebbles, down amongst which a stream of sulphuric acid and water is kept continually trickling. The acid and water is received into a vessel below, and returned, to be again used until exhausted. In order to prevent the deposition of soot from clogging the interstices of the pebbles, a stream of water must be occasionally forced through the shaft.

Claim.—The obtaining of ammonia from the gaseous products of coke ovens and furnaces, or places other than close vessels used for the combustion or partial combustion and distillation of coal, by passing such gaseous matters through, or in contact with acid, water, or other substance capable of collecting the same.

Improvements in treating the fleeces of sheep when on the animal. ALEXANDER MEIN, of Glasgow, acountant. (A communication from the late James Smith, of Deanston, Perth.) Patent dated December 7, 1850.

This invention consists in dipping the sheep into a succession of chemical solutions, so as to obtain an insoluble or sparingly soluble and water-repellent coating to the fibres of wool, thus increasing the warmth and promoting the health of the animal, and at the same time rendering the wool better suited for manufacturing purposes.

The bath into which the sheep are first dipped is composed by dissolving 20 lbs. of alum in 4 gallons of boiling water, and diluting to 40 gallons; the second bath

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consists of 31 lbs. of soft or black soap dissolved in a like quantity of water; and these baths will be sufficient for one hundred sheep. The dipping (for which three persons will be required—two to hold the sheep and the third to keep its head out of the solution) is recommended to be performed in a vessel of about 4 feet long, 2½ feet deep, and 2 feet wide, and capable of holding about 20 gallons; the sheep being allowed to dry between each successive dip. Arsenic or sulphur, to prevent the attacks of flies, &c., may be added to the above solutions if thought necessary.

Claim.—The application of chemical solutions suitably prepared to obtain, when used in succession, an insoluble or sparingly soluble and water-repellent coating to the fibres of wool when on the animal.

Improvements in dyeing. CHARLES AUGUSTUS KURTZ, of Cornbrook-House, Hulme, near Manchester, in the county of Lancaster, practical chemist. (Communication.) Patent dated November 19th, 1850. Enrolled May 19th, 1851.

BEFORE proceeding to point out the nature of his improvements in dyeing, the patentee describes the process at present employed, to produce results somewhat *analogous* to those obtained by his invention. In order to dye skeins or hanks of wool, silk, or cotton, or other material, in such a manner as to allow certain portions thereof to retain the original color, whilst other portions are dyed of different colors, the following method is adopted.

The material is first printed on by block, or machinery, and then parts of the skein or hank, are firmly bound round by cloth, calico, or bladder, tied by strong cord, and then thrown into a dye-bath, until the exposed portion of the material is sufficiently dyed; it is then dried, and the covering being removed, the hank or skein shews party colors, such as white, blue, yellow, red, &c.; the edges or parts where the different colors meet, being strongly marked by the pressure of the cord, &c. In order to perform this party coloring better, and to obtain a blending or gradual fading of one color into the other, which is much esteemed, the patentee proceeds as follows:—

Supposing that the hank or skein of silk to be operated on, is white, and that the colors desired are a gradual fading or blending of green into white; the skein is first to be tied into as great a number of slip-knots as may be required; the skein so tied up, is then placed in the green dye-bath, and when sufficiently saturated with coloring matter, it is removed, cleansed, and washed. On unslipping the knots, it will be found that those portions of the skeins which have formed the knots, retain the white color, with the exception that at their edges, the green color has more or less insinuated itself, so as to have formed a succession of shades; the silk is then again cleaned and dried: the same process is repeated when a variety of colors are required, fewer knots being tied in the first instance; thus, if white, yellow, green, and blue, are required, proceed as above mentioned, place in yellow dye-bath, cleanse, but do not unslip the knots; then tie up as much as is required to be kept yellow, and put into blue dye-bath, and so on. A great variety of colors and shades may thus be obtained.

The patentee does not claim the dyeing of silk, cotton, woollen, or other material, but he claims the mode above described, of dyeing skeins or hanks of silk, or other material, so as to produce irregular edges of various colored shades.

Improvements in the means or appliances used in conveying telegraphic intelligence between different places. GEORGE SHEPHERD, of Holborn-bars, civil engineer, and CHARLES BUTTON, operative chemist. Patent dated November 23, 1850.

These improvements have relation to submarine electric telegraphs, and comprehend,

1. A method of saturating flannel or other suitable fabric with certain chemical compositions (in which white and red lead, gutta percha, creosote, and boiled oil are among the ingredients employed), and using this saturated flannel for wrapping around a strand of gutta percha containing the insulated wires, and finally enveloping the whole with metal or metal wire, either plaited, laid, or coiled, around the said strand so wrapped in saturated flannel.

2. Protecting the insulated wires by laying them in the angular spaces formed by the junction of the links of a chain, whether such chain be composed of links round or oval, or bars of iron bolted or shackled together.

3. A peculiar construction of clamp for attaching the wires to the chains.

4. Attaching the wires to a rope or flexible band, not being a chain.

5. A testing apparatus to be attached to

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the submerging line of wires for indicating any defect therein.

6. The employment of floating signal buoys, and of immersed buoys attached to the line of wires horizontally between the testing apparatus, and vertically between the testing apparatuses and the signal buoys.

7. A peculiar form or forms of casting for protecting the wires on their arrival at the sea shore, the parts of such casing being united by horizontal and vertical flanges and bolts.

8. A method or methods of securing the wires of the electro-marine line on the sea-shore by bolting the casing containing the same either to the rocks or to piles sunk in the shore.

Improved chemical compounds for tissue bandages, wafers, and also for surgical purposes. JEAN PAUL GAGE, of Paris, chemist. Patent dated January 31, 1851.

Mr. Gage produces what he calls a "vegeto-metallic" tissue by mixing resins or resinous gums (such as gutta percha, India rubber, &c.) and granulated or laminated metals, or blades of metals, capable of exciting electric action, the effect of which is in some cases increased by immersing the tissue in vinegar and water, which is requisite, more especially for surgical purposes; when the tissue is intended for the manufacture of wafers, it is sprinkled with granulated metal, and cut into small discs of a suitable size, which are to be warmed before being applied to the letter requiring to be sealed.

CLAIMS.—1. The chemical compositions described.

2. The various vegeto metallic tissues resulting from these compounds.

3. Their application to the treatment of diseases.

4. The vegeto-metallic wafers described.

Improvements in the manufacture of indigo. JEAN AIME MARNAS, of Lyons. Patent dated December 12th, 1850. Enrolled June 12th, 1851.

THIS invention relates to a more economical method of obtaining soluble blue, or Saxony blue, from indigo, than that hitherto employed. The mode at present adopted for obtaining this blue is, to add a solution of indigo in sulphuric acid, to water, and place in it skeins of woollen yarn, or pieces of woollen cloth, which absorb the sulphuric acid, and any impurities, in the solution; cold water is then poured on the colored yarn or cloth, to remove all traces of sulphuric acid, and it is then immersed in warm water, slightly alkalised, by means of soda or potassa, which dissolves the coloring matter contained in the yarn or cloth. To the blue solution thus obtained, acid is added, to precipitate the green matter, which, though soluble in alkalies, is insoluble in acids, and the pure blue solution is poured off for use. The improvement adopted by the patentee, consists of the substitution of waste wool, especially flock wool, for the yarn or cloth above mentioned. The advantages derivable from the employment of the waste or flock wool are, first, that the almost pulverulent state of the flock wool admits of the exposure of a much larger surface to the absorption of the coloring matter. Secondly, that the flock wool is far more economical than woollen cloth. Thirdly, that the coloring matter is more readily given up to the alkaline liquor, by the flock wool, than by cloth; and lastly, that the coloring matter attendant on the use of the cloth, amounting to at least 10 per cent., is saved by the use of flock wool; this loss being occasioned by the formation of a gummy substance, (by the continued action of alkali on woollen cloth), which oxidises and destroys a portion of the coloring matter of the indigo. In the employment of flock wool for this purpose, the patentee proceeds as follows: in a solution of the sulphate of indigo in water, he places the flock wool, and after the lapse of about half-an-hour, he runs off the solution, and adds to it some more flock wool, or some which has previously been employed for absorbing purposes, until the whole of the coloring matter has been extracted: the drained wool is then washed with cold water, to remove any sulphuric acid, and afterwards placed in a warm alkaline solution of potassa or soda, and thrown into bags and pressed. To the solution of blue coloring matter thus obtained, a sufficient quantity of acid is added, to precipitate the green matter, which, on passing the whole through, a filter, remains thereon, the pure blue solution passing through, of such a consistency as to form a solid mass on cooling. The same flock wool may be used over and over again, and when at last it has lost its absorbing power, it may be employed in the same way as flock wool which has not been so treated, for the purposes of manure, or the manufacture of prussiate of potassa, as none of its nitrogenous principles have been injured in the process above mentioned. The residuary acid liquor, from which the coloring matter has been re-

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moved, may be used in the manufacture of sulphate of iron, or, added to colcothar, be employed in the preparation of the Nordhausen, or fuming oil of vitriol, which is the acid best adapted for the solution of indigo.

The patentee lays no claim to the application of the residuary matters to the purposes named, but claims as his invention, the use of waste wool, more particularly flock wool, as a means of economically and entirely abstracting the coloring matter from solutions of sulphate of indigo, and carmine of indigo, and forming Saxony or soluble blue.

Improvements in coating and covering metals. EDMUND MOREWOOD, of Enfield, in the county of Middlesex, gentleman, and GEORGE ROGERS, of the same place, gentleman. Patent dated December 12th, 1850. Enrolled June 12th, 1851.

THE first part of the specification contains the description of various methods of coating one metal with another; thus, to coat zinc with lead, by casting, they place a quantity of melted lead in a flat shallow pan of an oblong shape, constructed of iron or other suitable material, of the depth of one inch, and of a size to be regulated by that of the sheet required; the temperature is then raised to a few degrees above the melting heat of zinc. Having thus a sheet of lead in the bottom of the pan, they either lay on it a sufficient quantity of cold zinc, and allow it to melt, or pour into the pan the requisite proportion of zinc previously melted. The two metals are kept in a fluid state a short time, when the impurities which rise to the surface should be skimmed off; the metals, if they have become mixed, will also separate from each other; the contents of the pan are now allowed to cool, either completely, or down to 300° Fah., when it may be extended by rollers in the usual way. If both sides of the zinc are required to be coated, the patentees direct the adoption of the following methods: after the slab of zinc or spelter has been prepared, in the way above described, and has cooled to a temperature a few degrees above the melting point of lead, sal-ammoniac, in powder, is to be sprinkled on its surface, and then a piece of lead rubbed along the surface of the hot spelter, so as to form a coating of lead over the surface of the zinc slab, which should be secured by wedging or some other means, to prevent the melted lead from obtaining access to the underside of the slab and floating it. Slabs heated in this way, may also be extended by rollers.

In coating zinc, or the direct alloys of zinc and copper, with copper, the patentees first prepare a thin slab or layer of copper, in the same way as above described for lead, and allow its temperature to fall to a few degrees above the melting point of zinc, or of the alloy to be employed, the surface being kept as clean as possible; or they take a forged plate of copper, and having cleaned its surface, and heated it to the required temperature, they sprinkle on it some powdered sal-ammoniac, or other suitable flux, and coat its surface with zinc, or the alloy, by rubbing it over with a bar, or piece of the metal required, until a covering of sufficient thickness has been obtained. If it be required to coat both sides of a slab of zinc or alloy, with copper, the patentees take two plates of copper, thinly coated in the way indicated, and place them upright on their ends or edges, in a mould formed of wrought iron, or fire-clay, the sides of the plates which are coated with zinc fronting each other. The mould is then placed in a reverberatory furnace, and heat applied, until the metal attains very near the melting point of zinc: a sufficient quantity of zinc is then poured into the mould, as will serve to fill up the space between the two plates of metal; care must be taken, that the melted zinc or alloy thus added, is not of a temperature sufficiently high to melt the zinc or alloy on the copper, and that previous to adding the melted zinc, or alloy, a sufficient space has been left to give the thickness of metal desired. The zinc or alloy must be prevented from running to the back of the copper, by the use of the ordinary precautions. These slabs or plates may also be extended by rolling, annealing them from time to time as may be required.

In preparing a compound slab of tin or solder upon lead, the patentees cast a quantity of lead in an iron pan, cleaning its surface by skimming off any impurities which rise; and when the temperature of the metal has lowered to within a few degrees of the melting point of tin or solder, they sprinkle sal-ammoniac on the surface of the lead, and rub it over lightly with a piece of tin or solder, until a coating of sufficient thickness has been obtained; or pour on the lead with great care, sufficient melted tin or solder, wherewith to effect the coating. The prepared slab, when cooled to the proper degree, may be extended by rolling. Spelter or zinc may also be coated with solder or tin, in the same manner as that for coating lead.

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In coating sheet-iron, the patentees take a sheet of zinced or zinced tinned-iron, and place it on a hot cast-iron plate, the surface of the sheet-iron having previously been wetted with a mixture of dilute muriatic acid and sal-ammoniac. When the temperature of the cast-iron plate is about that of the melting point of lead, they pour melted lead over it, and whilst the latter is in a fluid state, they pass a warm roller over the surface of the plate, to ensure a coating of uniform thickness: the requisite precautions being taken in this, as in the former cases, to prevent the metal employed for coating to get to the under side of the metal to be coated.

The patentees state, that one object they have in view, in preparing lead or zinc with a coating of solder or tin, as above described, is the coating of sheet-iron with zinc or lead, for which purpose they adopt the following plan: the sheets having been rolled out of the requisite size and thickness, they take a sheet of zinced-iron, and having first wetted its surface with the acid preparation above mentioned, they place it on a cast-iron plate, previously heated to a few degrees above the temperature at which the solder or the tin melts, and having wetted the face of the tinned or soldered face of the sheet of lead with muriatic acid, they lay the wetted side upon the zinced-iron, and subject it to the slight pressure of a roller which has been heated to about the melting point of the tin or solder employed. A colder roller is next passed over the surface of the metal, in order to cause the solder or tin to set, and to bind the sheet of lead to the surface of the sheet of iron; the re-melting of the tin or solder being prevented, by means of a cold plate of iron passed under the sheet-iron. The same method may be adopted to unite lead, previously prepared as above described, with a tin or solder facing, to zinc. Should sheet-iron be required, coated with some metal, such as solder or tin, capable of melting at a somewhat low temperature, and, having prepared the sheets of lead or zinc in the way above described, with a tin or solder facing, they lay one of these latter sheets on a cast-iron plate, (previously heated to the melting point of tin or solder, but not high enough to melt zinc or lead,) then the sheet-iron plate, and on that another lead or zinc plate, and when the temperature has been raised to the melting point of tin or solder, they proceed in the manner above described, for coating the iron on one side only, by cementing.

If zinc be required coated on both sides with lead, the same method is to be used; the zinc may afterwards be extended by rolling. In coating zinc with lead, by cementing, with a view to extension by rolling, the patentees take a piece of lead, about five inches square, and coat it on one side with some more fusible metal, such as solder or tin; they then take a slab of zinc or spelter, and having cleaned one side of it with muriatic acid, and afterwards washed it with water, and place on it a mixture of muriatic acid, (and sal-ammoniac.) They then lay it on a cast-iron plate, previously heated to within a few degrees of the melting point of solder, and place the tinned or soldered face of the plate of lead upon it. As soon as the zinc has become hot enough to melt the solder, they pass a roller, previously heated to about the melting point of solder, slowly along the lead, which is thus kept down to the surface of the zinc. The plate or slab thus formed is then removed, and when cooled down to the required point, rolled in the ordinary way. The thickness of the plate admits of much variation; about $\frac{1}{8}$ths of an inch is perhaps the best.

Another part of the patentees' invention relates to the use of a reverberatory furnace, when coating with lead or zinc. They place a layer of powdered charcoal, coke, or other suitable material, on the surface of the melted lead, or zinc, contained in an iron vessel or pan, in a reverberatory furnace. The flame of the furnace ignites the carbonaceous material employed, which is kept in an incandescent state. The size of the vessel or pan, and the arrangements as to heating, will depend on the size of the articles, to be dipped in the melted metal. The patentees prefer the use of charcoal or coke; but if coal be used, care should be taken to avoid dipping the articles whilst much smoke is given off. The articles to be coated are to be previously dipped either in muriatic acid, or in a strong solution of muriate of ammonia.

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III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE PRESIDENT'S ADDRESS TO THE PHARMACEUTICAL SOCIETY AT THE LAST GENERAL MEETING.

We have read with much satisfaction and pleasure the address of Mr. Ince to the Pharmaceutical Society at the annual meeting held on the 20th May. It is not often that the chief officials of the Pharmaceutical Society evince a regard for the interests of the great mass of its members. Mr. Ince, however stands forward as a dignified and honorable exception, and we have some hope that his expressed opinions will meet with the attention they deserve. We consider this address so important and so useful, that we have determined on giving it *in extenso*.

"Gentlemen,

"I appear before you as the representative of the Council, elected by yourselves to carry on the affairs of the Pharmaceutical Society of Great Britain. You did me the honor last year of returning me one of your Council, which by lot will extend to another year. Your Council proposing me as their President, I reluctantly accepted it—that reluctance arising from a sense of my own inability to do the office justice, my health not being so firm as I could wish; however, I am now here, as you see, to render an account of our stewardship. I have but little to say by way of preliminary observations to the Report which will be read to you, and which it will be your duty to scan and criticise. We are very desirous that you should know all our affairs: we desire to withhold no information—and most gladly shall we listen to any remarks which may have reference to the future prosperity of the Society. Before I go the subject of the Report allow me to offer some general observations on Pharmacy and its progress. It does not fall to my lot to introduce to your notice any new remedies of importance which the genius of Pharmaceutists has presented to Medical Science during the past year.

"Some of those previously in use, however, have acquired increased reputation, while others seem destined to a less favorable result. You have cod liver oil now in large consumption, employing considerable capital—equally beneficial to the diseased, and profitable to the dispenser. Strychnine, in its various forms, is extensively employed in medicine; and, I am informed, is now used in astonishing quantities in the destruction of fur-bearing animals, the skins being less injured by this process of destroying life than some others. Chloroform increases in reputation. Cotyledon and kousso, I fear, will not stand the test of experience. The extravagant price of the latter reminds one of the recommendation of the medical man to his patient to go to Madeira—or take horse exercise—when in fact the patient had not the means to buy his daily bread. The compounds of valerianic acid are interesting, and no doubt some of them will be found to be valuable remedial agents. The salts of iron, with citric acid, ammonia, and quinine, have a continued demand.

"As to our influence, we may mention the Sale of Arsenic Bill, now before the legislature, the enactments of which will not very much interfere with us. It is denuded, we think, of all mischief, by the exertions of the previous examination which had been given to the subject by our Committee.

"I have to notice the issue of two new Pharmacopœias since our last Anniversary—the one from Dublin, and the other from the Royal College of Physicians of London, to whose high privileges we most submissively bow. These Pharmacopœias are great improvements upon their predecessors—they show much advancement in a right direction; but it is deeply to be regretted that the London College, whom we are called upon to follow, should not have called to their assistance a few well-known Chemists and Druggists, whose long experience and extensive knowledge in Practical Pharmacy would have guaranteed them from some of the errors and inconsistencies which are so palpable in their last production. In this department it cannot be doubted that men, whose every-day employment is the compounding of medicine and the improvement of Pharmacy, have vastly the advan-

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tage over professional men whose time is almost exclusively occupied in the investigation of disease.

"I am glad that translators and commentators of Pharmacopœias are appearing from our own body. One of our former Presidents announces a work on the subject, and our esteemed and valuable Professor of Pharmacy another. I am sorry to know that Mr. R. Phillips, for many years past the able translator and annotator of the London Pharmacopœia, is no longer amongst the living—he died last week, the day before the formal opening of the Museum of Practical Geology, of which he was the distinguished scientific Secretary or Curator. You are aware he was originally a Chemist in the Poultry. The glaring errors of the new Pharmacopœia of that day called forth from his pen a very able and acute critique on that work, in a pamphlet entitled, *Some Observations on certain Preparations of the New London Pharmacopœia.* I believe the remarks were so generally correct as to acquire for him great praise, and entitle him to rank as an able Chemist. The College had to surrender at discretion, and ultimately chose him as their adviser.

"It has given me great pleasure also to find many of our Members diligently employed in duties connected with the benefit of the country, especially in the sanitary movements now so loudly demanded. I must mention the names of Mr. Liddell, of Hull, formerly a London Chemist, and Mr. Dakin, of London, formerly one of your Council.

"And now you will allow me to travel back to the Pharmaceutical Society. The sittings of the Council, I can assure you, have been well attended. With one exception we have had a full board of generally twenty members. Our labors have not been slight—many have been the discussions; and, although we have not been agreed upon some subjects (for uniformity would be dreadfully dull) yet we have always thought it right to carry out the principles of the majority in their full integrity. I need not disguise that which I have reason to believe is well known to some of you at least, that I have not unfrequently been in the minority. I may be forgiven if, for this once, I tell you that I have watched carefully the interests of this Society from its commencement. I had no selfish motive to join with it. I think if I had to draw a balance it would be against me, except your favor. We sprang up into existence under the influence of threatened wrong and oppression, speedily became a powerfully united body, and then trammelled ourselves with a charter before we were quite certain what were our requirements. Under these circumstances it is not to be wondered at that everything was not altogether as representative as we could desire. I could have wished the election of Council to have been in the whole body of Members: the power to vote, in London personally only; five miles from London by post. This, I think, would have us more united. One-third of the Council should have remained by rotation, not by lot. The Secretary, and probably the Professor, should have been the choice of the whole body.

"I have some settled opinions with reference to the Society, and you must bear with my stating them this once. One point to which I allude is that on which many of the Members, in conjunction with others, memorialised the Council, having reference to the Transactions of the Society and the Journal, in which they are distributed at the cost and charge of our funds. Another is the Secretarial department. I am thoroughly persuaded in my own mind that no learned society or body can take rank, or station, or influence, or increase in numbers, except it has a Secretary devoted entirely to its service, who, from education and scientific knowledge, is equal to take the lead in every department, and to be always available. The business of accounts, taking minutes, keeping books, carrying on ordinary correspondence, is very good and proper, and is very well done by your present Secretary, who, I trust, will not misunderstand me in these observations, which do not detract from his services. The next notion I have is, that we are fettered in our house. It was a mistake to be here without out-door premises for laboratory purposes, for we are seriously crippled for want of space to extend our operations. Already our Museum has outgrown the room devoted to it, and the Secretary has ceased to have residence in the house.

"The last opinion I shall mention is that with reference to our legal standing. We have made no real advance yet:—have our efforts been in the right direction? The Chemist and Druggist of the present day originated really fifty or sixty years ago, not much earlier. A few Apothecaries, disliking to have the annoyance of being roused from their beds and boards, contrived to draw all their practice to their own little shops, and in course of time they became the retailers of physic without visiting the patients; by degrees the public began to approve of the plan, and the re-

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tailer also improved the quality of his physic, having more employment for it; moreover, enlightenment with reference to the nature and quality of drugs opened the way to the public attempting to doctor themselves. In process of time they required the experience of the dealer of physic to be added to the physic itself. It soon appeared desirable to take the superior medical man's advice upon paper, and thus to a great extent, the status of the intermediate visiting Apothecary was altered. The public, always alive to their own interests, saw it worked well—in fact it was a step towards free trade. Many rushed into the new-created order, and now the Chemist and Druggist is expected to be always ready with his choice stock of effective drugs, and also to prepare with great accuracy the prescriptions and recipes of the medical advisers, who no longer supply the medicines. From the Chemist and Druggist is also expected, in minor cases of disease, that relief which it is believed he can, without danger, give. An immense amount of good is thus effected, and much bodily suffering spared; and although it may be true that in some cases a more accurate knowledge would have deterred him from interfering, yet the trifling mischief thus effected is so completely counterbalanced by the enormous benefit conferred, that any attempt to cripple the Chemist and Druggist would crowd the Houses of Parliament with petitions in his favor. Hence legislative interference can only go in one direction, that of requiring qualification from those who call themselves Chemists and Druggists.

"The Report will tell its own tale. The Finance Report will, I think, appear in a more business-like form than formerly. We have destroyed all the terms of "Old Fund," &c. On examining the grounds on which these distinctions rested we found them unnecessary. The Benevolent Fund is sacredly kept for the purposes intended; it has hitherto borne no part of the expense of management.

"The new Council will, probably, also consider whether it will not be advisable, on the Laboratory account, first to charge the expenses and then remunerate the Professor. I deeply regret the cause of that part which will be read to you with reference to the Lecture department. I had expected better things. We have thought of throwing the Lectures entirely open. If I could transport myself back to former times, what would I have given for these opportunities—but I forbear.

"In conclusion, I hope here we shall be all harmonious. After the Report will be the election of Members of Council; let those be elected who you think have the Society's interest at heart. Any observations I have made are not subjects for discussion, the Report alone is the official part of this meeting. I have made these remarks only by your courtesy.

"I had it in my mind to say something about underselling one another—how thoroughly degrading it is, and, on the whole, how unprofitable to any of us! I have seen, during the year, evidence of it, which has pained me. The world is wide enough for the whole of us. Let us cultivate good feeling one for another, not only here but at our own homes."

The first point in Mr. Ince's address to which we will call the attention of our readers is that in which he expresses his wish that the Council should be elected by "the whole body of members," and that the power of voting should be "in London personally only, and five miles from London by post," and that one-third of the Council should remain "by rotation, not by lot." This might be agreeable to the views of honest, disinterested men like the gentleman whose address we have just quoted: but it would put an end to nepotism, and the interested manœuvres of a certain clique who are always in office, and who dare not trust to the suffrages of the members. "The Secretary, and probably the Professor, should have been the choice of the whole body." Certainly the whole body is called upon to pay them. But how horrible to contemplate is the bare possibility that these officers might have been chosen for eminent talent or from other motives than the private friendship of, or near relationship to, some influential members!

Mr. Ince, as we infer from his observations, also dissents from the incorporation of the transactions of the Society with the Journal published by the *Member for St. Albans*, and the distribution of this publication at the expence of the Society. This is a point which we hope will shortly be brought before the Council, as we perceive that several of the members of the Council are of the number of those who last year, with great zeal, carried about for signature

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a memorial expressing their disapprobation of the present mode of publication and distribution. We shall keep our eye on these gentlemen, and hope that there will be no backsliding, which we shall unhesitatingly denounce. Unfortunately, the council-room has frequently been the tomb of good intentions. A place at the Board is a "*price*" at which malcontents sometimes readily snap. However, let us prejudge no one.

We are glad to find, from Mr. Ince's statement, that the Financial Report, appears in a more business-like form than formerly. We shall look over it, and see if any points of importance attract our attention.

In concluding these few observations, we cannot but congratulate the Society on having so entirely disinterested and unselfish a President as Mr. Ince, and if the Society does not feel so grateful as it ought, he will have the great internal consolation of the *mens conscia recti*, and the good opinion of all who are not hopelessly sunk in moral and Pharmaceutical degradation.

THE FINANCIAL REPORT OF THE PHARMACEUTICAL SOCIETY.

From this Report it appears that the total expenditure of the Society for the year ending on the 31st December, 1850, was, £3391 15s. 5d., on some items of which expenditure we shall make a few remarks.

The Council has appropriated £943 14s. of the Society's money: viz., in lectures £530 8s. laboratory expences, £255 5s. 6d.; and professor, £158 0s. 6d.; from which sum have to be deducted the receipts for lecture fees, £52 10s., and for laboratory fees, half-session, £316 1s.=£368 11s; showing a clear loss of £591 18s. in the teaching department of the Society, to say nothing of the portion of rent, wages, &c. This loss should be stopped at once, or the School must sink to the level of a charitable institution. Perhaps the Council will explain the £530 8s. for lectures: who delivered them, and how much was paid to each lecturer? What opinion can the members form of the mode in which their money is bestowed, unless they know more than can be learned from the item "Lectures, £530 8s."? No one can dispute the fact of the money having been so spent; but many people will doubt if it ought to have been disposed of in any such way. Perhaps the lecturers were too highly paid; at any rate the members have a right to be satisfied on this point, and so has the whole public, when it is considered that a Bill is before Parliament absolutely asking for additional powers for this ill-managed Society: this, however, is not very likely to be granted. This sacrifice of the Society's funds to the emolument of a few individuals should be stopped, and that immediately.

Another abomination is the expenditure £766 4s. in the Journal and its distribution. The Society should publish its own transactions, which might appear once or twice a year as a distinct work, and leave Mr. Bell's Journal and all other journals to their own merits or demerits, for success or failure. We trust that certain members of the Council will energetically raise their voices against the continuation of this iniquity, and we dare say they will do so with effect.

By way of relief to the foregoing, we may state that the library expences were only £14 11s. 10d., and those of the museum absolutely 13s. 6d! The contrast is striking.

THE PHARMACY BILL.

As Mr. Bell has not sent us a copy of the Bill which he has taken the advantage of his position as M.P. for St. Albans to present to the House of Commons, we are not in a situation to give an abstract of it, and the omission leads us to suspect that the proposed measure may be intended for the benefit of the Society or rather of those individuals who have hitherto generally contrived to make the advantages of the Society their own, to the exclusion perhaps of those of the trade who have not the good fortune to be connected with the clique by which the administration of the affairs of the Society

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has been held for so many years. If, however, the Bill in question, should when we see it, appear likely to benefit the trade, it shall have our best support. But we cannot help regarding with suspicion every thing coming from so questionable a quarter.

We are fully alive to the advantages which might accrue to the trade from one of its members being in Parliament, and should have rejoiced at his being thus placed in a position to serve those interests over which we have always watched, and that principally against himself, had we any confidence in his motives, and had not the circumstances of his election been such as to forbid congratulation or the expression of any feeling but regret at the prostitution of a great public privilege on the part of many of the electors of the notorious Borough of St. Albans. Still, if Mr. Bell's Bill be a good measure, we will give it our support, and will omit from our consideration the circumstance that it has been submitted to Parliament only when it could be no longer delayed, and not brood over the delinquency of the renowned Waggett and his companions, who still defy the House of Commons and enjoy unmolested repose in Boulogne.

OBSERVATIONS ON COPAIBA.*

BY MR. WILLIAM PROCTER, JUN.

COPAIBA as a drug, under the name of Balsam of Copaiva, has been known and written about for more than two hundred years, and its valuable remedial powers have attracted and received the deliberate attention of Physicians, Pharmaceutists, and Chemists, for many years past.

The genus Copaifera is an extensive one; its species though occurring most largely in the forests of Northern and Eastern Brazil, are found in those of Guiana, Venezuela, and in some of the West India islands. As yet, no writer has described accurately the botanical sources of the several kinds of copaiba found in commerce, nor have travellers satisfactorily ascertained whether each of these is invariably the product of a single species of copaifera, or whether they are sometimes the mixed products of several species growing together in the region of collection. "According to Hayne, the species from which most of the copaiba of commerce is derived is the C. multijuga, growing in the province of Perà." (U. S. Disp.) But the C. Martii of Hayne, and perhaps other species, grow in that neighborhood, and may contribute to the Parà balsam. The copaiba derived from the vicinity of Rio Janeiro is attributed to C. Langsdorffii and C. coriacea, but the sources of the Angostura, Maracaibo, and West Indian drugs are quite uncertain, although attributed to C. officinalis. It is to be regretted that so accurate an observer as Dr. Weddell, did not investigate the copaiferæ whilst a sojourner in South America.

The extensive demand for copaiba has caused it to be sought in various localities, and from numerous species; and it is probable that climate, and the modes of extraction and preservation, taken in connexion with its variable botanical origin, may be referred to as the most prominent and active causes of the remarkable variations in the sensible properties and chemical constitution of the drug itself. It is with a view of throwing some additional light on this subject that the writer has hazarded an opinion in relation to the collection of some specimens of the drug, found in commerce of late years, which he has not as yet been able to verify or disprove by information obtained from their geographical sources, but which is based on observations made on the effects of age and exposure on copaiba, and its volatile oil.

In approaching the subject, it will be viewed, 1st., in reference to the proximate constituents of copaiba; 2nd., the proportional relations of these in the copaibas of commerce; 3rd., the causes existing and acting, before and after the juice is extracted, which modify the quantitative relation of its constituents. And, lastly, conclusions.

1st. The proximate constituents of copaiba, from whatever source, are volatile oil and resin, with a minute portion of some soluble organic acid, (probably the acetic or succinic) and, in some instances, fatty matter.

The *volatile oil of copaiba* is constituted much like that of turpentine. Its equivalent is $C^{10}H^8$, which makes it isomeric with the oil of lemons, and just one-half of that of oil of turpentine. It forms a crystalline artificial camphor with hydrochloric acid gas, which differs from those of the oil of turpentine and lemons. Its specific gravity is 878; it boils at 473° F., but undergoes a slight alteration, unless oxygen is excluded; it is very soluble in anhydrous alcohol, but much less so in that of officinal strength (·835). It is the cause of the peculiar penetrating odor of copaiba, and has a biting extremely disagreeable persistent taste. Duraud first ascertained it to be a hydro-carbon, by noticing its in-

* *American Journal of Pharmacy.*

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difference towards potassium, which keeps well in it. It is gradually resinified by exposure to the air.

The resinous portion of copaiba consists of two distinct substances; one of these is a strong resinous acid, to which the name of *copaivic acid* has been given. The other is neutral, incapable of uniting with bases, has a permanently soft consistence, is soluble in anhydrous alcohol and ether, and insoluble in weak alcohol, and mineral naphtha.

Copaivic acid is inodorous and nearly insipid, soluble in ether, alcohol, and the volatile oils, and its alcoholic solution reddens litmus paper. It forms combinations with bases which are generally soluble in ether and alcohol. It has the same ultimate composition as colophony, the resin of European turpentine, $C^{40}\ H^{32}\ O^4$. It is usually amorphous like ordinary resin, but Schweitzer has obtained it in colorless crystals. Its salt of magnesia is the basis of the officinal copaiba pills.

2d. Let us now examine the proportional relations of these constituents as they occur in the copaibas of commerce.

According to the analysis of Stoltze, copaiba contains 38· of volatile oil, 52·75 copaivic acid, 1·66 soft resin, 7·59 water and loss.

Gerber's analysis of fresh copaiba gives ·41 volatile oil, 51·38 copaivic acid, 2·18 soft resin, 5·44 water and loss.

Gerber's analysis of old copaiba gives 31·7 volatile oil, 53·68 copaivic acid, 11·15 soft resin, 4·1 water and loss.

Durand found 50 of volatile oil and 50 of resin, including a little fatty matter, acetic acid and perhaps water, without isolating the copaivic acid.

According to Guibourt, copaiba yields 45 volatile oil, and the resinous residue consists of 98 parts of copaivic acid and two parts soft resin.

Mr. Whipple (Pereira) obtained 48 per cent. of resin, and 52 per cent. of volatile oil.

In addition to the above, I have examined five specimens of copaiba obtained at different times in the Philadelphia market, and also a sample of oil of copaiba which had been kept long in a bottle imperfectly stopped, until it became slightly resinous and more viscid than copaiba itself. As a means of distinguishing them, I will attach the letters of the alphabet. The method adopted to ascertain the amount of oil and resin, was to place a weighed quantity, say 100 grains, of the specimen, in a small weighed capsule, and expose it to a regular heat at about 250° F., until the oil was evaporated, and it ceased to lose weight. The capsule was then weighed, and the loss ascertained. Although this method of analysis is not so accurate as distillation with water, using a larger quantity, and weighing the distilled oil and the residue resin separately, yet it is sufficiently precise to answer the object of the writer.

(*a.*) This specimen was remarkable for being very slightly resinous. Its specific gravity was only 9·16; its odor purely that of copaiba; it was light straw colored, very fluid, and consisted of 80 parts of volatile oil, and 20 parts of resin. The latter was soft, adhered to the fingers, and was slightly acid to litmus when dissolved in alcohol. The origin of this specimen is uncertain, but it is believed to be from Parà. Sixty grains of it was heated several minutes with one sixteenth of recently calcined magnesia, and set aside twenty-four hours. No combination ensued; the magnesia settled to the bottom, the copaiba remaining transparent above it.

(*b.*) Origin unknown, consistence rather thin, odor good, color brownish yellow, and sp. grav. ·956. It consisted of 65 parts volatile oil, and 35 of resin; when heated with one-sixteenth of magnesia and set aside twenty-four hours, only partial union followed, a part of the magnesia precipitated, and a part was taken up by the oleoresin, which remained turbid.

(*c.*) This specimen has a thick consistence, its sp. grav. 983; is several years old, but its origin is not known, although it looks like that from Angostura. It consists of 50 parts of volatile oil, and 50 parts of resin. The resin is pulverisable, and quite acid to litmus when dissolved in alcohol. Heated with one-sixteenth of magnesia, it became tolerably consistent on cooling, but did not acquire a pillular consistence after thirty-six hours.

(*d.*) This sample, obtained as Angostura copaiba, has a density of ·985, is transparent, has a light brown color, correct odor, and thick consistence. It consisted of 35 parts of oil and 65 of resin. The resin was not fragile and pulverisable, but soft and sticky between the fingers. Heated with one-sixteenth of magnesia, it acquired on cooling a thick consistence, and at the end of thirty-six hours its consistence was firmer than that of *c.* The resin was quite acid to litmus.

(*e.*) This specimen has been in my possession several years, it was obtained as "solidifiable balsam," but its origin is unknown. Its color dark yellowish brown, consistence thicker, its odor more aromatic than either of the preceding, and its density

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·986. It consisted of 34 parts volatile oil, and 66 parts of resin, the alcoholic solution of which was strongly acid to litmus paper. When heated with one-sixteenth of magnesia, its consistence was almost pillular on cooling, and after twenty-four hours was fit for use.

(*f.*) This specimen was oil of copaiba obtained by distillation, that had been kept five years in a cracked bottle, so as to admit the air. Its consistence is thicker than either of the preceding copaibas, has a bright amber color, is perfectly transparent, readily soluble in commercial alcohol, and its solution hardly reddens litmus paper. It consists of volatile oil 66, soft resin 34.

When mixed with one-sixteenth of magnesia and allowed to stand five days, no combination ensued; it was then heated, with no increase of solidity, except what might be attributed to loss of oil; in other words, though thick and resinous, it is not solidifiable, because it contains no copaivic acid.

The following table exhibits these results at one view.

	Stolze.	Gerber's fresh Copaiba.	Gerber's old Copaiba.	Durand.	Guibourt.	Wipple.	*a*	*b*	*c*	*d*	*e*	*f*
Volatile oil ..	38.	41·	31·7	50	45·	48	80	65	50	35	34	66
Copaivic acid	52.75	51·38	53·68	} 50	53·9	} 52	} 20	} 35	} 50	} 65	} 66	34
Soft resin	1·66	2·18	11·15		1·1							
Water and loss	7·59	5·44	4·10									

By a comparison of these results, we are first struck with the great variation in the proportion of volatile oil, which varies from 31 to 80 per cent. Second, in the three first and the fifth analyses, the ratio of copaivic acid is nearly equal, while the soft resin varies from 1·66 to 11·15 per cent., being greatest in the oldest. Third, That only three specimens containing from 50 to 60 per cent. of resin will solidify. Fourth, That the resin in the specimen *a* differs from all the rest both in color, consistence, and want of acidity, the copaiba being apparently immature; and, lastly, That in the spontaneous oxidation of copaiba and its volatile oil, it is the soft resin only that is formed.

3d. The causes modifying the proximate constitution of copaiba, existing and acting before and after the extraction of the juice, are several.

It is an ascertained fact that the ascending juices of plants, particularly of trees, are much more simple than those which descend, after having passed the circulation of the leaves; and the principles deposited by the downward current contain more carbon and less oxygen than those contained in the ascending current. This arises from the chemical changes going on in the leaves during the action of light on them, by which oxygen is evolved from the carbonic acid and other constituents of the juices. "Their green leaves absorb the chemical rays of the sun so completely as to give no image in the daguerreotype." (*Graham.*) This deoxidising and carbon-depositing action appears to go on to a much greater extent in olieferous and resineferous plants than in others.

Now it appears from observations made by different observers, that as the copaiba trees get older, their juices become more oleo-resinous, that is to say, the process of oxidation to which the volatile oil is subjected, causes it to become more resinous year after year, and it is only after a certain age that, in the opinion of the copaiba collectors, the trees are fit to be tapped. The analysis of Rose proves that copaivic acid is the oxide of the oil of copaiba; thus the formula of the acid is $C^{40} H^{32} O^4$, whilst that of the oil is $C^{10} H^8$, which quadrupled $= C^{42} H^{32}$, and this plus $O^4 =$ the formula of the acid.

Again; as the juices of the older trees are more resinous, and beyond doubt there is a period in their growth when the volatile oil is associated with comparatively little resin. Now the writer is willing to hazard the opinion that the specimen of copaiba distinguished by (*a*) in the table was extracted at this period of the tree, when not only the oil was in great excess, but the resin not completely elaborated; in other words, not converted into copaivic acid. This view is indirectly corroborated by the fact that there are one or two oleo-resins, containing but a trifle of resin, which are obtained by tapping, from trees

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growing in Venezuela. One of these, called "native oil of laurel or sassafras," obtained from trees growing on the banks of the Orinoko, about 400 miles from its mouth, is now under examination, and will be noticed in the next number.

The judgments of the medicinal value of copaiba, have generally been based on its consistence and solidifying property. The observations of writers on therapeutics have shown that nearly all its peculiar efficacy is due to the volatile oil. If this is true, and there appears no reason to doubt it, the "solidifiable balsam" is the least valuable as a medicine, and it becomes an important question whether the practice of extracting the juice from the older trees is the most eligible?. It is for therapeutists to ascertain whether such copaiba as (*a*) is or is not better than such as (*e*.)

It is apparent from the analyses above detailed, that copaivic acid is a *natural* product formed in the juice of the plant, and not after its extraction, by exposure to the air. The examination of old copaiba by Gerber, and of the specimen (*f*) of old oil of copaiba by the writer, especially show this; hence, if any given specimens of the drug be not naturally possessed of about 50 per cent. of copaivic acid, no subsequent oxidation will render it solidifiable.

The soft resin formed by oxidation of the oil appears to give more consistence to the drug weight for weight, than the copaivic acid, probably from being less soluble, and hence old copaiba is not only thicker in consistence from loss of volatile oil by evaporation, but from the formation of the soft resin. It is highly probable that specimens of copaiba may be met with, which, originally immature and slightly resinous, have become thick and resinous from exposure. Such copaiba will not solidify for the causes mentioned. The remarks by Joseph Laidley at page 121 of this volume tend to corroborate some of the statements in this paper, whilst these explain the difficulties met with by that writer.

ON THE ACTION OF HARD WATER ON LEAD.*

BY DR. NEVINS, OF LIVERPOOL.

THE question of the supply of water to large cities, has, within the last two years, occupied a considerable share of public attention; and in connection with this subject, the nature of the channels through which the water is conducted, and of the vessels or reservoirs in which it is kept stored for use, has also obtained particular notice. The subject is one of such paramount importance to the health of the community, that too much investigation cannot possibly be given to it. It was supposed that soft waters, containing but a very small portion of earthy or saline ingredients, were alone capable of acting on lead, and that hard waters exerted no such action. Recent investigations have, however, shown, that whilst certain kinds of hard water exercise a protecting influence on lead, there are others which produce action upon that metal, and which, therefore, ought not to be kept for use in leaden reservoirs. The following experiments carefully made by Dr. Nevins, will, therefore, be read with much interest.

Sheet lead and common lead piping were exposed to the action of water containing the following solutions, with the results now to be described. In every case the lead remained in the water for a week.

Description of Experiments.—In the first set of experiments, sheet and pipe-lead was exposed to the action of a strong solution of sulphate of magnesia (gr. 4, and also gr. 10 to the ounce) in distilled water.

2nd set.—The same solutions of sulphate of magnesia, combined with bicarbonate of soda (gr. 4 in the ounce.)

3d. set.—Carbonate of magnesia, partially redissolved by carbonic acid in distilled water.

4th set.—Carbonate of lime, partially redissolved by carbonic acid gas in the same way.

5th set.—Solution of common salt (gr. ½ in the ounce) in distilled water, and the same strength in the common spring water of Liverpool, which contains a moderate quantity of sulphate of lime.

6th set—Solutions of common salt as above, only stronger (gr. 2 in the ounce.)

7th set.—Solutions of common salt gr. ½ and gr. 2 in the ounce) in combination with gr. 1 and gr. 4 of sulphate of magnesia respectively (*i. e.* gr. ½ with gr. 1, and gr. 2 with gr. 4.)

8th set.—The same experiment, only substituting chloride of calcium for chloride of sodium.

Object of the Experiments.—It will be seen on examining the above experiments, that nearly every point in dispute was brought under investigation; viz., the action of *hard* water, which does not contain

* *Patent Journal.*

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sulphates, in experiments 3 and 4; the action of *strong* solutions of sulphates in experiment 1; the modifying effect of the presence of excess of carbonic acid along with the sulphates in experiment 2; the effect of chlorides of various strength in distilled water, and in water containing small and large amounts of sulphates, of both lime and magnesia; in experiments 5, 6, and 7, the difference in the effect of chlorides of equal strength, dependent upon difference in the base with which the chlorine is combined; and lastly, the difference in the effect produced upon sheet lead and common pipe lead.

Results.—Different kinds of lead.—The difference between the effect of the sheet and the pipe-lead was so slight in every case, as scarcely to merit notice. If anything, the pipe-lead was the least affected, as shown by the visible effect of sulphuretted hydrogen, for quantitative analysis was not resorted to in any instance. When, however, tea-lead, was operated upon, the difference was very great; which corresponds with results I obtained many years since, in which I found, that whilst the deposit from pure lead in a certain time, weighed 5·5 grains, that from an equal surface of tea-lead placed under precisely similar circumstances, weighed 11·5 grains.

This result might almost be anticipated, as impurity in common pipe-lead is more likely to be zinc than any other metal, and this would retard rather than hasten the action of the water upon the lead, by forming a galvanic arrangement; whilst the tin, which is stated to be present in the tea-lead, would hasten the action upon the lead, as it is less easily acted upon by chemical agents than lead itself. The difference in effect of the different strengths of the same solution, was by no means strongly marked, the result being so nearly the same at the end of the week's trial, that it is unnecessary to make any distinction in speaking of them, between the solution of four grains of sulphate of magnesia and that of ten grains; between the half-grain and the two grains solution of chloride of calcium, &c.

Sulphates.—The solution of sulphate of magnesia produced a very decided effect. The bottom of the jar in which the experiment was made, became covered with a thick white layer, and a coating, similar in appearance, covered the surface of the lead, but was removed without difficulty by gentle scraping with the nail. On transmitting sulphuretted hydrogen, the white sediment became black powder, and the water assumed a brown hue. Thus it was clear that the strong solution of the sulphate did not form a protecting layer upon the lead, though repeated experiments, year by year, shown to my class of chemical students, have confirmed beyond dispute, that the Liverpool water, which contains a small quantity of sulphate of lime, does protect it. It appears to me, that the difference in the effect of a strong and a weak solution of a sulphate, is owing to the rapidity with which the precipitate is formed by the first, which prevents its adhering firmly; while, in the second, it is formed so slowly, that its adhesion is uniform and perfect.

Carbonates.—All the carbonates acted upon the lead, so far as to cause the water to become decidedly colored by the sulphuretted hydrogen, and a dark-colored deposit was formed amongst the superfluous carbonate of lime and magnesia. The effect from the bicarbonate of soda was the most decided, and this, notwithstanding the presence of a small quantity of sulphate of lime in the common spring water, and of a large quantity of sulphate of magnesia in the distilled water, whence it is evident that neither a large nor a small quantity of a sulphate acts as a protection, in the presence of a soluble carbonate.

Chlorides.—In every case the water became brown on the transmission of the sulphuretted hydrogen, but the solution of chloride of calcium was far the most affected, and a decided coating was formed upon the lead in it, which was not the case in any of the solutions of common salt, in which the lead retained its ordinary appearance, and no precipitate was formed upon the bottom of the jars. The effect of the chlorides was therefore less marked than that of the other solutions employed.

Conclusions.—From the above experiments, it is clear that *hard* waters do not protect lead, simply from the fact of their being hard; but that the protection, when effected, is dependent, not only upon the nature of the salt causing the hardness, but also upon the proportion present; for whilst all experience proves that a small amount of a sulphate, at any rate of sulphate of lime, does protect the lead, a large quantity of sulphate of magnesia acted considerably upon it. It appears also to be proved, that chlorides act upon lead, whether with or without the presence of a sulphate, but that their action is not so great as that of soluble carbonates, which produce a rapidly injurious effect upon the metal. At the same time, these results do not practically affect the ques-

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tion of the safety of using lead for common waters, so far as sulphates, at any rate, are concerned, inasmuch as the solutions here employed, were out of all proportion stronger than any ordinary spring water, and the experience of years has proved, that there are no bad consequences practically occasioned by the employment of the metal for water containing sulphates.

[As a precautionary measure, we would recommend the employment of gutta percha as a lining for water cisterns and reservoirs, by which means the danger arising from the use of lead will be avoided.—ED. *Patent Journal.*—A suggestion which has our entire concurrence.—EDS. CHEM.]

POISONOUS PROPERTIES OF NICOTINE.*

BY M. ORFILA.

M. ORFILA read an essay, which had for its principal object to demonstrate:—1stly, That nicotine can be as certainly distinguished, as any poison derived from the animal kingdom; 2ndly, that this alkaloïd can be detected in the intestinal canal and its presence affirmed, although only a few drops of it be present in the intestinal canal; 3rdly, that its presence can be detected after its absorption into the substance of the liver and other organs. 1st, Nicotine, discovered in 1809, by the illustrious Vauquelin, was studied in 1828, by MM. Posselt and Beimann, who found it in the various species of tobacco. It was classed by them with the two other volatile natural alkalies, *conicine* and *théobromine*. Composed of hydrogen, carbon, and nitrogen, it may be represented as one equivalent of ammonia, HN^3, and one of carburetted hydrogen, containing four equivalents of hydrogen, and ten of carbon, $H^4 C^{10}$. It is obtained by passing the vapor of tobacco through water acidulated by sulphuric acid; the sulphate thus obtained being decomposed by a strong fixed alkali, the nicotine is thus volatilised by moderate heat. This mode of preparation points out that by inhaling the fumes of tobacco, during smoking, a portion of nicotine is introduced into the system.

Pure anhydrous nicotine is a colorless oleaginous liquid, sp. gr. 1·048, becoming yellow by keeping, and on exposure to the atmosphere changing to a brown color, and becoming thick in consistence, by the absorption of oxygen; its acrid odor has but slight resemblance to that of tobacco, its taste has a burning pungency; it volatilises at 250° F., leaving a carbonaceous residue; its fumes are extremely irritating; it is inflammable, being readily ignited, burning with a white flame and yielding abundant charcoal; it reddens turmeric; it is soluble in water, in alcohol, oils, and also in ether, which speedily separates it from a watery solution.

Nicotine combines directly with acids, heat being disengaged. Concentrated pure sulphuric acid in the cold gives a red wine color; when heated, the liquid assumes the appearance of wine lees, and at a boiling temperature blackens, with the disengagement of sulphurous acid. Hydrochloric acid imparts to it a violet tint. Nitric acid an orange tint. With stearic acid it forms a soap. Its simple salts are deliquescent, and not so easily crystallised as its double salts. Its aqueous solution is colorless, transparent, and strongly alkaline; it behaves like ammonia with many reagents; thus it gives a white precipitate with the bichloride of mercury, acetate of lead, and chloride of tin; and with chloride of platinum a canary yellow; the salts of zinc are precipitated white, and are redissolved by the liquid in excess; the acetate of copper is thrown down blue, and is soluble in excess; with salts of manganese it has the same action as ammonia. The following tests distinguish its aqueous solution from that of ammonia: it precipitates the chloride of gold reddish yellow, and redissolves it by excess; it precipitates chloride of cobalt blue, passing into green, and does not redissolve the precipitate as ammonia does; solution of iodine precipitates it of a yellow color, whereas ammonia discharges the color.

If to the chemical characters by which nicotine is thus distinguished, its action on the animal economy be added, it will be impossible to confound it with any other substance. M. Orfila related several experiments which he had performed, and which are published in the fourth edition of his "*Toxicologie Générale.*" These experiments show that nicotine has a directly injurious influence upon the central organs of the nervous system.

2. M. Orfila then proceeded to discuss the *second proposition*, viz., that nicotine can be detected in the digestive canal, when even only a few drops have been taken. The author pointed out that in the animals experimented upon, neither vomiting nor action on the bowels followed after its administration. The contents of the canal

* Paris Academy of Medicine.

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were acted upon by ether which dissolved out the nicotine. The following method was considered by M. Orfila to be the best for the detection of nicotine in the digestive canal. The substances to be analysed are to be macerated in very diluted sulphuric acid for about twelve hours, and then to be filtered; the result will be a solution of sulphate of nicotine with some organic matters. This is to be evaporated to dryness in a sand bath; then treated with distilled water, which will dissolve the sulphate and leave the organic matters. Soda or potassa is to be added, the nicotine distilled over, and the product evaporated in a sand bath to obtain the nicotine free from water. The tests before mentioned can then be applied.

3. In support of his third proposition, M. Orfila stated that the substance of the liver having been subjected to a similar examination as that to which the intestines were submitted, has been found to yield evidence of the presence of the poison.

M. Orfila concluded with some observations on a recent investigation of a case of poisoning by nicotine, at Mons, in Belgium.

REMARKS ON DIGITALINE.*

BY M. BOUCHARDAT.

I WAS of opinion, and a perusal of the learned report of M. Bouillaud on the works of MM. Homolle and Quevenne has convinced me that in reading (*Annuaire de Therapeutique*, 1845) the description of the experiments performed by MM. Sandras and myself, in studying the physiological property of digitaline, some physicians, considering the great activity of this reagent, had conceived exaggerated fears concerning its employment in therapeutics.

I am convinced, and I shall endeavor to prove by experiment that these experiments and the collection of clinical facts inserted in that work should on the contrary lead us to prefer digitaline, *in all cases* in which the employment of digitalis is well indicated, to the powder of digitalis.

It is quite evident that it is necessary to avoid deducing hastily from the effects produced by a substance introduced by injection into the veins, those which it would produce when introduced into the digestive apparatus. To show how much risk we run of being deceived in endeavoring to assimilate these effects, I need only refer to the experiments which I performed with my lamented colleague, Stuart Cooper (*Annuaire de Therapeutique*, 1847, p. 230), on the comparative effects of chloride, bromide and iodide of potassium injected into the veins, which experiment demonstrated that which could not be foreseen *à priori*, that iodide of potassium thus injected is much more inoffensive than the chloride of the same metal.

The same difference cannot be adduced as regards digitaline. The iodide is not decomposed when injected into the veins, consequently, the action of iodide is not developed. Digitaline, on the contrary, acts in the same manner, whether it be introduced into the circulation by gastro-intestinal absorption or by injection into the veins. Only, we are much more sure that it penetrates into the circulation when injected into the veins than introduced by the mouth, I own, however, that adopting the reserve of the learned reporter of the Academy of Medicine, I should always have great dread of too high doses of preparations of digitalis, and that I should not reckon too much on the assistance of their emetic property. This is a favorable property, it is true, but its importance must not be overrated, for the vomitings induced by digitalis are often secondary to its absorption. Be this as it may, I am convinced that the method of injecting into the veins is excellent for judging well and surely of the physiological value of most medicaments. They have been very useful to us for fixing with certainty the limits of the poisonous action of digitaline.

Because digitaline is extremely active, must it be concluded that its employment should be renounced? If this reasoning were followed, it would be necessary to abandon the use of all the most powerful medicines. To employ digitaline with safety, certain results of observation and experience must never be lost sight of. We stated, in our Memoir, (*Annuaire de Therapeutique*, 1845, p. 67), that: "the physiological effects of digitaline are not in general produced immediately: during the first few days, it sometimes seems as if the patient had not taken anything unusual; but suddenly, and, as it were, without notice, the effects begin to manifest themselves. Its action should, therefore, be most attentively watched, &c."

The truly admirable physiological experiments which one of the authors made on himself and on dogs with digitaline, which experiments have given evidence of the scarcely suspected laws of the action of this powerful modifier of the circulation, give

* *Répertoire de Pharmacie.*

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considerable support to the opinions expressed in our memoir of 1845.

From these experiments, which one of the authors so courageously and patiently performed, it is demonstrated that the minimum abatement of the pulsations never correspond, so to speak, with the period of administration of the digitaline, but with that of repose after the cessation of the use of the medicine. This result proves that the medicine continues its action for some time after its administration is discontinued. It is evident, therefore, that digitaline is a medicine of long duration. If it were given in high doses, effects would suddenly supervene which it is indispensable to have previous warning of.

These effects are nausea, vomiting, and various derangements of the digestive apparatus; more rarely symptoms connected with the nervous system: a considerable diminution of the number of pulsations, unusual coldness, and something still more serious if digitaline has been administered in too large a dose, to a patient enfeebled by disease. The most important practical point issuing out of this discussion is that, of all medicines furnished by the vegetable kingdom, there is none to which we become so little accustomed as the preparations of digitalis. There are doses which, in certain conditions cannot be exceeded without danger. We must not reckon on habitude when administering digitaline; it differs entirely in this point of view, from morphia, atropine, &c.

It is precisely because there is no habituation to the preparations of digitalis, and because there is danger in augmenting the dose too much that a physician who likes to be certain of what he is doing will always prefer digitaline to all the preparations of digitalis, when he has decided on having recourse to this powerful modifying agent. With digitaline, administered under the form of granules, he knows what he gives; he knows precisely when he must stop; he is sure of acting, and of acting in perfect security. With powder of digitalis and all the preparations derived from it, all is doubt and hesitation; with the same formula, you may prescribe, according to the digitalis employed, a dose containing one or three doses of the active principle. What a frightful alternative with a medicine the dose of which it is so necessary to regulate! If accidents have not happened more frequently, it is because we rarely arrive, with the preparations of digitalis, at the limit of useful doses. The therapeutical object is not then attained. With digitaline security is attained if we begin with one or two granules of a milligramme each, and if we do not exceed five granules or five milligrammes of digitaline. Nothing can be more certain or simple: doubt must actually be preferred to certainty in prescribing the preparations of digitalis, in which the proportions of the active principle is so variable, when we possess their principle in the isolated form.

The following is another objection which may be offered:

Does digitaline represent all the proportions of digitalis? If I may credit my own experience, I may reply: as faithfully as quinine represents cinchona.

The experiments of authors, and the observations of M. Bouillaud have most clearly proved that digitaline is the principle to which digitalis owes its valuable property of lowering and regulating the circulation. The facts which I have observed are all conformable to this appreciation.

The experiments made by M. Bouillaud tend to prove that the diuretic action of digitaline is far from being constant, since it has not been carefully noticed except in one of the subjects to whom digitaline had been administered.

Exactly the same thing is observed with the other preparations of digitalis: their diuretic action is far from being constant. It is the same with all the medicines ranked in the section of diuretics. It is only in certain circumstances that they increase the quantity of the urine. I do not any the less regard digitaline and digitalis as very valuable diuretics, when administered at a proper opportunity. Given by chance, they very rarely succeed. When properly indicated, and especially when well associated, they seldom fail.

The following are the conditions in which I have most successfully employed the preparations of digitalis as diuretics; namely, in cases of ascites accompanied by infiltration of the lower members, without fever and without albumen in the urine. These cases are seldom observed in the hospitals of Paris, where infiltration with fever and albumen in urine is of much more frequent occurrence; but they are more common in the old men of our wine country who have not led very temperate lives. To succeed in these conditions with digitaline or the preparations of digitalis, they must be ordered in high doses (from 4 to 6 milligrammes of digitaline); but it is good to associate with them a drastic purgative, like scammony, which did not appear to me to diminish the useful effect, and which may be valuable for diminishing the chances of accidents, which, however, I never observed

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in these particular cases, although I have employed this means very frequently.

I have said that I gave digitalis in doses corresponding, for 24 hours, to from 4 to 6 milligrammes of digitaline; scammony in the dose of 20 to 30 centigrammes, and squills in the same proportion.

If some skilful physicians distrust digitalis, or have employed it very little, either as a diuretic, or for moderating and regulating the action of the heart, I am convinced that, if they employed it only in the cases in which it is precisely indicated; if, instead of preparations unworthy of confidence they adopt digitaline exclusively, never exceeding without great caution from 4 to 5 granules of 1 milligramme each, they will acknowledge that few medicines are more serviceable.

MM. Homolle and Quevenne, in regulating the employment of digitaline, and in making known its active principle, have, I am convinced, rendered great service to therapeutics, and the reporter of the Academy has given a just and well-merited recompense to this great work, in appreciating, as they deserve, those beautiful physiological experiments which have fixed the laws of the decrease of the pulse under the influence of digitaline, experiments performed during long years with a patience almost unknown in our time, and of which examples must be sought in the cloisters of the Benedictines; experiments executed with the courage of a savant; for a very firm determination must have been required for taking, for so long a time and with the sole object of enlightening science, physiological doses of so energetic a substance.

THE GREAT INDUSTRIAL EXHIBITION.

Owing to the late period at which we obtained our ticket from the Executive Committee, we have not been able to make a diligent inspection of the Chemicals of other countries, and to compare them with those of our own. We have noticed more particularly those of France and the United States. We must, however, refrain from giving our opinion on them until next month.

We were much pleased with some specimens, exhibited by Mr. Clifford, of deeds and other articles which had sustained damage, and which he had restored so as to be quite legible. One specimen was a portion of a deed taken from the ruins of an extensive fire in Lincoln's Inn, and which has the dirty half attached. By Mr. C.'s process, flexibility is imparted, and the writing is rendered quite plain. He also exhibits two leaves of a book; two leaves of *The Jurist* newspaper, and portions of parchment from the same fire, injured by both fire and water, a map, and several small engravings injured by age, smoke, mildew and dirt, with the restored halves attached. We were informed by Mr. Clifford that the process was invented by him, and that he is very extensively employed by the legal profession in his very useful avocation.

TO CORRESPONDENTS.

"Anti-Quackery."—We have received a printed extract from the *Liverpool Mercury* of 15th June, being a letter to the Editor of that paper, bearing this signature. In the present form, it appears to us, that the matter treated of is chiefly of local interest. Perhaps our correspondent will write to us on the subject, and communicate his name in strict confidence. We have not had leisure to make the comparison, but will do so by the time the No. is out.

"Experto Crede."—Your name and address are necessary to us as an authentication of your statements. They need not be published. Please to write as soon as you see this. We never insert anonymous communications, unless the real name and address of the writer are communicated to us.

"F. B." will hear from us by post, as requested.

"M.P.S.G.B.," and "A.P.S.," are right in their views.

"A Student."—Brande's Manual.

"M.D." will find the information he desires in our present No.

Introduction to the Study of Chemistry.—The third of this series will be published in our August No.

Notice.—*All Communications, Books for Review and Substance for Notice must be addressed* "To the Editors of The Chemist, care of Messrs. W. & T. Piper, Paternoster Row, London." *Communications for insertion must be prepaid, and sent before the 15th of each month. Letters requiring a reply in the following Nos. will in future be received as late as the 24th.*

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

INTRODUCTION TO THE STUDY OF CHEMISTRY.

NO. III.

HAVING in the former two articles briefly, but, we trust, sufficiently, explained to the student the laws which preside over the combination of bodies with each other, and the system of nomenclature adopted by chemists of the present day, we shall now commence the description of all the simple bodies and of the compounds they form with each other.

The order in which we shall arrange our work will be as follows:—We shall first treat of the non-metallic simple substances; 2ndly, of the metals; and 3rdly of the chemistry of vegetable and animal substances. These are the great divisions of chemistry recognised throughout the world, which, although not free from objection, are at least very convenient.

The first two divisions constitute what is called inorganic chemistry, which we may define as the chemistry of bodies not possessing vital functions or not derived from bodies endowed with those functions: the third constitutes what is denominated organic chemistry:—that is to say, the chemistry of bodies endowed with vital functions and of bodies derived from them; the bodies in this division are all compounds.

A knowledge of inorganic chemistry is indispensable to the comprehension of organic chemistry, especially as it is usual to treat the Elements as inorganic, and of course the elements should be treated of before their compounds.

In this classification we have somewhat closely followed the plan adopted by Professor Brande, thus sacrificing originality to convenience of arrangement. Indeed we can lay no claim to originality in these articles, as of course, all our instructions are compiled from the most evident sources. Our sole object is to condense the valuable information contained in the great books into a small compass and to bring it to the comprehension of beginners, hoping that, by this means many persons will be induced to commence the study of chemistry who would not otherwise have undertaken it, and who would, perhaps, have been rather alarmed than attracted by the large and excellent elementary works.

We have undertaken no light task in this, and it makes no trifling demands on our time, which is otherwise much occupied by a great variety of chemical matters. But we shall esteem this time well bestowed if we have the good fortune to spread the knowledge of this wonderful and useful science.

CHEMISTRY OF THE NON-METALLIC SIMPLE BODIES.

Following the example of Professor Brande, in his excellent "Manual of Chemistry," we shall not divide the non-metallic simple bodies into two or more classes, according to the practice of Berzelius and others, but shall treat of them in the following order, which is that of Professor Brande.

I. L

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I. Oxygen.
II. Chlorine and its combinations with oxygen.
III. Iodine and its combination with the two preceding substances.
IV. Bromine ,, ,, ,,
V. Fluorine ,, ,, ,,
VI. Hydrogen ,, ,, ,,
VII. Nitrogen ,, ,, ,,
VIII. Sulphur ,, ,, ,,
IX. Selenium ,, ,, ,,
X. Phosphorus ,, ,, ,,
XI. Carbon ,, ,, ,,
XII. Boron ,, ,, ,,

Silicon, we shall, like him, "for the convenience which such arrangement affords in describing some of its most important compounds, such as glass, artificial gems and colored glasses, in which the metals and their oxides are so essentially concerned," retain among the metals.

In order to impress the symbols and equivalents of bodies more fully on the student, we shall add them to the names of each at the head of the chapter treating of them, a plan which will be found of great service when we come to treat of compounds.

OXYGEN. O. 8.

This gas was discovered in the year 1774, by Dr. Priestle, who called it *dephlogisticated* air: Scheele called it *empyreal* air, and Condorcet *vital* air. Its present name is derived from the two Greek words ὀξὺς acid, and γεινομαι, to generate, and was given to it in consequence of its tendency to form acid compounds. It exists in nature in greater abundance than any other element, forming eight-ninths of the water, more than one-fifth of the atmosphere, and about one-third of the matter of the globe.

PREPARATION.—There are many ways of preparing oxygen, but we shall here describe only those which are most commonly resorted to, reserving notice of others until we come to treat of the substances which yield it under special circumstances.

To obtain perfectly pure oxygen, a small quantity, say 100 grains of the chlorate of potassa is introduced into a small glass retort and gently heated over a spirit-lamp to rather above the degree at which it enters into fusion. To the back of the retort should be previously fitted a small glass, bent in the shape of the letter S, the end of which should be placed under the shelf of the pneumatic trough, and the atmospheric air contained in the apparatus allowed to escape. The oxygen is now to be collected in the proper receivers. It is necessary to apply the heat very gradually, so that the salt may not be too quickly decomposed: the bubbles of gas should not be allowed to follow each other in very rapid succession, particularly towards the close of the operation. The heat may however be increased at last, so as to make the bottom of the retort red-hot, care being taken not to fuse the glass. When no more gas is evolved, the retort should be disconnected from the pneumatic trough. 100 parts of chlorate of potassa yield 39 of oxygen by weight. One ounce troy furnishes 187 grains, or 543 cubic inches, or about as much as is produced from six ounces of average black oxide of manganese in the process we are about to describe.

2. The black or peroxide of manganese is introduced into a wrought iron bottle, the neck of which is fitted with an iron gun-barrel; to this gun barrel a smaller tube, of glass, is connected. This bottle should not be more than two-thirds filled with powdered and well-dried peroxide of manganese. The bottle should be placed horizontally either in a common fire or in a furnace. The gas may be collected as in the foregoing process. The oxygen thus obtained is not pure. The purest oxygen is that obtained from chlorate of potassa and collected over mercury.

It should also be dried by passing it through tubes containing chloride of calcium, or pieces of pummice stone moistened with sulphuric acid.

3. Oxygen may likewise be obtained by heating the red oxide of mercury in a retort of hard glass, connected with a receiver fitted with a tube passing to the pneumatic trough. This retort is heated over an argand spirit-lamp, the oxide of mercury is decomposed into mercury and oxygen—the former condensing in the neck of the retort and running into the receiver, and the latter passing through the apparatus into the bell glass of the pneumatic trough.

4. Oxygen may also be produced by heating a mixture of sulphuric acid and black oxide of manganese of the consistence of cream in a glass retort, over an argand lamp.

5. Peroxide of lead may also be used for its production. However when perfectly pure oxygen is required, the process with chlorate of potassa must be employed; when purity is of no moment, black oxide of manganese heated in an iron bottle is the most convenient source.

Oxygen in the isolated state exists only in the gaseous form; it is tasteless, odorless, and invisible: its specific gravity is, ac-

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cording to Berzelius and Dulong 1·1026: Biot, 1·0359; De Saussure, 1·10562; Thomson, 1·111; Davy, 1·127;—atmospheric air being 1·000. Its specific gravity compared with hydrogen is =16, hydrogen being=1. At mean temperature 100 cubic inches weigh 34·60 grains; at the temperature of 32° F., according to Dr. Thomson, 100 cubic inches weigh 36·43.

Oxygen refracts light less than any other substance. Its absolute refraction, according to Biot and Arago, is only 0·000560204; compared with atmospheric air, its refractive index is 0.86161, air being=1·000. Its specific heat, compared with atmospheric air is, according to Berzelius, (*Traité de Chémie,*), 0·242 : 1000; according to De la Roche and Berard, its specific heat, compared with an equal *volume* of air=0·9765, and with an equal *weight* of air,=0·8848—(Brande's Manual.)

Oxygen is a powerful supporter of respiration, a property of which we shall treat in speaking of atmospheric air.

It is also a very powerful supporter of combustion. If a lighted taper be blown out, so as to leave the wick still burning, the light is instantly rekindled on being immersed in a jar containing oxygen.

Phosphorus burns in oxygen gas emitting a light the intensity of which the eye is almost incapable of sustaining, and evolving a very intense heat.

A piece of charcoal, made red-hot and immersed in a jar of oxygen is rapidly consumed with innumerable brilliant scintillations.

The power of oxygen as a supporter of combustion is beautifully shown by burning iron wire. The oxygen should be very pure and contained in a large gas jar, placed in water in a soup plate. A piece of rather stout annealed iron wire is attached to the stopper, and some harpsichord wire is loosely wound round it; the sulphur end of a match is then attached to the lower end of it; the match is lighted, and the wire introduced into the jar; the most brilliant combustion speedily commences; very bright sparks are thrown off, and globules of oxide of iron drop through the water on to the plate, the glaze of which they frequent fuse. A piece of annealed watch spring or iron or steel shavings may be used in this experiment.

The glass jar should be held during these experiments so as to prevent it from jarring on the plate, and a little gas should occasionally be permitted to escape, as the sudden expansion might otherwise cause the glass to break.

In the combustion of any substance with oxygen, the combustible and the oxygen combine, and the weight of the former is increased in proportion to the quantity of the latter with which it has entered into combination.

The combination of a body with oxygen, whether by combustion or by other processes which will be noticed in their proper places, is called, *oxygenation*, *oxidisement* or *oxidation*. The process of depriving substances of oxygen is called *disoxygenation*, *deoxidisement*, *deoxidation*, or reduction. All the simple bodies may be oxidised, and, in most cases, at certain temperatures, this oxidation is accompanied by the evolution of light and heat. When a body is saturated with oxygen, that is to say, is incapable of combining with a further quantity of it, it is incombustible. All bodies saturated with supporters of combustion are rendered incombustible; all substances of organic nature are capable of entering into combustion.

Until the discovery of oxygen, all the phenomena of combustion were regarded by Stahl and those who subscribed to his views as due to a peculiar principle which they denominated phlogiston. This principle was supposed to exist in all combustible bodies, and combustion was supposed to be attendant on its separation. The increase of the weight of bodies during the process of combustion was decidedly opposed to this hypothesis, which was apparently upheld by experimental evidence. The discovery of this gas, however, led the celebrated Lavoisier to regard oxygen as the universal supporter of combustion, supposing that the basis of the gas combined with the combustible substance, and that the heat and light which it previously contained in the state of gas were evolved in the form of flame. But the light depends on the nature of the combustible, and not on the amount of oxygen consumed; besides, oxygen, in many instances of combustion, instead of solidifying, becomes gaseous; thus the theory of latent heat is insufficient to account for the phenomena. Again as oxygen is *not* the sole supporter of combustion, there are many cases of combustion in which oxygen is not present. "Combustion therefore," to quote the words of Professor Brande, "cannot be regarded as dependent upon any peculiar principle or form of matter, but must be considered as a general result of intense chemical action. It may be connected with the electrical energies of bodies, for all bodies which powerfully act upon each other are in the opposite electrical

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states of positive and negative; and the evolution of heat and light may depend upon the annihilation of these opposite states, which happens whenever they combine."

ON THE DIFFUSION OF LIQUIDS.*

BY THOMAS GRAHAM, ESQ., F.R.S., F.C.S., PROFESSOR OF CHEMISTRY, IN UNIVERSITY COLLEGE.

(Continued from page 437.)

14. *Acetate of lead.*—Diffused for 16·166 days; the time chosen formerly for sulphate of magnesia, with seven days for chloride of sodium. The solution contained 0·965 per cent. of anhydrous salt, with the density 1·0080. As this solution of acetate of lead was found to be precipitated by pure water, about 2 per cent. of strong acetic acid was introduced into the solution, and the same acid was added in a less proportion to the water jars. The salt of lead diffused was afterwards determined by means of sulphuric acid. Diffused in eight cells, at 53°·1, 7·45, 7·29, 7·46 and 8·07 grs.; mean 7·56; or 7·84 for 1 per cent. in two cells.

15. *Acetate of baryta.*—Diffused for 16·166 days. The solution contained 0·977 per cent. of anhydrous salt, with the density of 1·0073. The same addition of acetic acid was made to it as to the preceding acetate of lead, in order that the circumstances of diffusion might be similar for both salts. The salt diffused was estimated also in the form of sulphate.

Diffusion of 1 per cent. solutions in 16.166 days; two cells.

Acetate of baryta at 53°·5..	7·50	100
Acetate of lead at 53°·1....	7·84	104·53

Here, of two isomorphous salts, that of greatest atomic weight sensibly exceeds the other in diffusibility.

16. *Chloride of barium.*—Time of diffusion 11·43 days. The diffused salt was weighed as sulphate of baryta.

Diffusion in 8·57 days at 63°; two cells.

	Grs.	Ratio.
From 1 per cent solution	6·32	1·047
From 2 per cent. solution	12·07	2
From 4 per cent. solution	23·96	3·970
From 8 per cent. solution	45·92	7 608

17. *Chloride of strontium.*—The diffused salt was weighed as sulphate of strontia.

Diffusion in 8 57 days at 63°; two cells.

	Grs.	Ratio.
From 1 per cent. solution	6·09	1·045
From 2 per cent. solution	11·66	2
From 4 per cent. solution	23·56	4·041
From 8 per cent. solution	44·46	7·626

The series of ratios in the preceding table will be found, on comparison, to correspond closely with the ratios of chloride of barium. It may be useful to compare farther the amounts diffused from similar solutions of these two isomorphous compounds.

Diffusion in 8·57 days at 63°; two cells.

Chloride of barium, 1 per cent.	6·32	100
Chloride of strontium, 1 percent.	6·09	96·36
Chloride of barium, 2 per cent.	12·07	100
Chloride of strontium, 2 percent.	11·66	96·90
Chloride of barium, 4 per cent.	23·96	100
Chloride of strontium, 4 per cent.	23·56	99·16
Chloride of barium, 8 per cent.	45 92	100
Chloride of strontium, 8 per cent.	44·46	96·83

The near coincidence of the 4 per cent. solutions probably arises from an accidental error of observation in the chloride of barium, for the latter departs here from the progression of its ratios. We appear then to have a small but constant difference of about 3½ per cent. in the diffusion of these two isomorphous salts, the chloride of barium, which possesses the highest atomic weight, having the advantage.

The diffusion of the 1 per cent. solution of the same salts for the longer period of 11·43 days, gives 7.50 for chloride of barium at 50°·9, and 7°·52 for chloride of strontium at 51°, or nearly the same temperature. For the first time we have in the barytic salts a divergence between chlorides and nitrates, for the nitrates of the same bases have a number about 6·8 only at the same temperature. I am led, however, to believe that this discrepancy becomes much less at low temperatures by experiments which are at present in progress.

18. *Chloride of calcium.*—Time of diffusion 11·43 days. The salt diffused was weighed as sulphate of lime.

Diffusion in 11·43 days at 63°·8; two cells.

	Grs.	Ratio.
From 1 per cent. solution	7·92	1·032
From 2 per cent. solution	15·35	2
From 4 per cent. solution	30·78	4·010
From 8 per cent. solution	61·56	8·021

We may now observe how far the diffusion of the chloride of calcium is analogous to that of nitrate of lime. At the inferior temperatures, the results for the 1 per

* *Quarterly Journal of the Chemical Society.*

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cent. solution of these two salts were as follow:

Chloride of calcium at 50°·9 .	6·51	100
Nitrate of lime at 51·5 . .	6·54	100·46

While at the higher temperatures, namely 63°8 for the chloride of calcium, and 64°·1 for the nitrate of lime, the results for the different proportions of salt are:

Chloride of calcium, 1 per cent.	7·92	100
Nitrate of lime, 1 per cent. .	7·66	96·72
Chloride of calcium, 2 per cent.	15·35	100
Nitrate of lime, 2 per cent. .	15·01	97·79
Chloride of calcium, 4 per cent.	30·78	100
Nitrate of lime, 4 per cent. .	29·04	94·35
Chloride of calcium, 8 per cent.	61·56	100
Nitrate of lime, 8 per cent. .	55·10	89·51

The correspondence between the 1 and 2 per cent. solutions of chloride and nitrate is sufficiently close, but in the 4 and 8 per cent. the salts diverge, as happens also with hydrochloric and nitric acids themselves. The nitrate in both falls off, while the chloride sustains throughout the high diffusibility of the lower proportions.

19. *Chloride of manganese.*—Time of diffusion 11·43 days. The salt diffused was estimated by means of nitrate of silver.

The 1 per cent. solution, of density 1·0085, gave at 50°·8, in eight cells, 6·67, 6·26, 6·79, and 6·81 grs.; mean 6·63 for two cells.

20. *Nitrate of magnesia.*—Time of diffusion 11·43 days. The salt diffused was estimated as sulphate.

The 1 per cent. solution, of density 1·0073, gave at 50°·8, in eight cells, 6·29, 6.39, 6·52, and 6·76 grs.; mean 6·49 for two cells.

21. *Nitrate of copper.*—Time of diffusion 11·43 days. The salt diffused was estimated from the oxide of copper obtained by ignition.

The 1 per cent. solution, of density 1·0075, in eight cells, at 50°·8, gave 6·52, 6·36, 6·18 and 6·70 grs.; mean 6·44 for two cells.

Comparing the preceding salts with chloride of calcium diffused at the same temperature, 50°·8, we have the following results:

Chloride of calcium....	6·51	100
Chloride of manganese...	6·63	101·15
Nitrate of magnesia....	6·49	99·69
Nitrate of copper.....	6·44	98·92

This group of salts, belonging to the same isomorphous family, of bases, the magnesian, again corresponds closely in diffusibility.

The following additional magnesian chlorides were diffused, all 1 per cent. solutions, either in six or in eight cells. The salt diffused was estimated by means of nitrate of silver.

The results referred to chloride of calcium, at nearly the same temperature, 50°·8, are as follow:

Chloride of calcium....	6·51	100
Chloride of zinc.....	6·29	96·61
Chloride of magnesium..	6·17	94·77
Chloride of copper.....	6·06	93·08

These salts present a greater latitude in their diffusibility, if belonging to the same class, than is usual.

22. *Protochloride of iron.*—A solution of this salt of 1·023 per cent. was diffused at 53°·5, a somewhat higher temperature than the corresponding chlorides. It gave 6·45, 6·48, 6·48 and 6·28 grs. in two cells; mean 6·44, or 6·30 for 1 per cent. in two cells. This salt appears therefore to belong to the last group.

23. *Sesquichloride of iron.*—A full series of observations was made upon the diffusion of the different proportions of this salt from 1 to 8 per cent., but in all of them decomposition was determined by the diffusion, with turpidity also in the solution-phial, except in the 8 per cent. solution.

The mean diffusion from the 1 per cent. solution in 11·43 days at 63°·3, was 4·13 grs. of sesquichloride of iron with 1·28 gr. of free hydrochloric acid, in two cells. This result indicates that one-half nearly of the sesquichloride of iron, is decomposed in the diffusion.

The mean diffusion from the 8 per cent. solution at 63°·3, was 55·88 grs. of sesquichloride of iron with 6·66 grs. of free hydrochloric acid, in two cells. It appears from this experiment that perchloride of iron approaches the chloride of calcium in diffusibility. That the proto- and persalts of the magnesian metals should have a similar rate of diffusion is not unlikely, from other analogies which they exhibit.

24. *Sulphate of magnesia.*—The time chosen for the diffusion of this salt, namely 16·166 days, is a multiple by 2 of the time of sulphate of potassa, and by 4 of the time of hydrate of potassa. The diffusate was evaporated to dryness and weighed.

Diffusion in 16·16 days at 65°·4; two cells.

	Grs.	Ratio.
From 1 per cent. solution	7·31	1·144
From 2 per cent. solution...	12·79	2
From 4 per cent. solution....	23·46	3·671
From 8 per cent. solution....	42·82	6·701
From 8 per cent. solution at 62°·8.....	42·66	1

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From 16 per cent. solution at 62°8..... 75·06 1·759
From 24 per cent. solution at 62°·8..... 102.04 2·340

25. *Sulphate of zinc.*—Time of diffusion 16·166 days. The diffused salt was evaporated to dryness and weighed.

Diffusion in 16·16 days at 65°·4; two cells.

	Grs.	Ratio.
From 1 per cent. solution....	6·67	1·091
From 2 per cent. solution....	12·22	2
From 4 per cent. solution....	23·12	3.784
From 8 per cent. solution....	42·26	6·916
From 8 per cent. solution at 62°·8.....	39·62	1
From 16 per cent. solution at 62°·8.....	74·40	1·878
From 24 per cent. solution at 62°·8.....	101·42	2·560

It will be remarked that the diffusion of these two isomorphous salts, sulphate of magnesia and sulphate of zinc, differs so much in the 1 per cent. solution, as 7·31 to 6·67, that is, as 100 to 91·25; or 8·75 per cent. This, I have no doubt, however, is an accidental error, the disturbances from changes of temperature and other causes of dispersion being in direct proportion to the duration of the experiment, and therefore much increased with these long times; while the 1 per cent. solution also appears to be generally the proportion most exposed to such errors. The sulphate of zinc appears to be the truest throughout in its diffusion, of these two salts. The approach to equality becomes close in the 4 per cent. and larger proportions of salt, particularly with the unusually high proportions of 16 and 24 per cent., which were observed in these salts. The diffusion of both salts falls off remarkably in the higher proportions. The result of the comparison of these two magnesian sulphates is no doubt favorable to the similarity of diffusion of isomorphous salts.

26. *Sulphate of alumina.*—The time of diffusion chosen was 16·166 days, or the same as that for sulphate of magnesia. The usual number of eight cells of the 1 and 2 per cent. solutions were diffused, and four cells of the 4 and 8 per cent. solutions. The whole diffusates of each proportion were then mixed together and the quantities of alumina and sulphuric acid, diffused for two cells, determined separately.

Diffusion in 16·166 days at 65°·4; two cells.

	Grs.	Ratio.
From 1 per cent. solution	5·48	1·074
From 2 per cent. solution	10·21	2
From 4 per cent. solution	19·28	3·780
From 8 per cent. solution	33·52	6·572

The diffusion of sulphate of alumina, it will be observed, is very sensibly less than that of sulphate of zinc at the same temperature.

27. *Nitrate of silver.*—Time of diffusion seven days. The quantity of salt diffused was ascertained by precipitation with hydrochloric acid, and weighing the chloride of silver formed.

Diffusion for seven days at 63°·5; two cells.

	Grs.	Ratio.
From 2 per cent. solution	13·61	2
From 4 per cent. solution	26·34	3·87
From 8 per cent. solution	51·88	7·62

28. *Nitrate of soda.*—Time of diffusion seven days. The quantity of salt diffused was ascertained by evaporation to dryness.

Diffusion in seven days at 63°·4; two cells.

	Grs.	Ratio.
From solution of 2 per cent.	12·35	2
From solution of 4 per cent.	23·56	3·82
From solution of 8 per cent.	47·74	7·72

The ratios of the last column of the preceding table are sensibly the same as those already obtained for nitrate of silver. But the diffusibility of nitrate of soda appears to be increased less rapidly by temperature than nitrate of silver. Hence the diffusibility of these two salts appears more similar at low than high temperatures.

Diffusion from 2 per cent. solutions in seven days at 53°.

Nitrate of silver.....	11·24	100
Nitrate of soda.....	10·81	96.17

Diffusion from 2 per cent. solutions in seven days at 63°·4.

Nitrate of silver.....	13·61	100
Nitrate of soda.....	12·35	90·74

29. *Chloride of sodium.*—Time of diffusion seven days. The salt diffused was treated with nitrate of silver, and the chloride of silver weighed.

Diffusion in seven days at 63°·4; two cells.

	Grs.	Ratio.
From 1 per cent. solution	6·32	1·023
From 2 per cent. solution	12·37	2
From 4 per cent. solution	24·96	4·036
From 8 per cent. solution	48.44	7·832

These numbers resemble closely those obtained in the diffusion of chloride of barium during the longer period of 8·57 days.

The chloride of sodium and nitrate of soda will be seen to exhibit the usual approach to parallelism between the chloride and nitrate of the same metal, by the following comparison:

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Diffusion of both at 63°·4.

Chloride of sodium, 2 per cent.	12·37	100
Nitrate of soda, 2 per cent...	12·35	99·83
Chloride of sodium, 4 per cent.	24·96	100
Nitrate of soda, 4 per cent...	23·58	94·48
Chloride of sodium, 8 per cent.	48·44	100
Nitrate of soda, 8 per cent...	47·74	98.55

As usual, the chloride is slightly more rapid in its diffusion than the nitrate

(To be concluded in our next.)

ON DIAMAGNETISM AND MAGNE CRYSTALLIC ACTION.*

BY DR. J. TYNDALL.

One of the most important inquiries which at the present day occupy the attention of the student of physical science, is the relation which subsists between magnetism and diamagnetism. Are the laws which govern both forces identical? Will the mathematical expression of the attraction in the one case be converted into that of the repulsion in the other case by a change of sign from positive to negative? To this question Plücker replies "No." His experiments have led him to the conclusion, that when the power of a magnet which operates upon a body composed of magnetic and diamagnetic constituents is increased, the diamagnetism of the compound mass increases in a much quicker ratio than the magnetism; that in consequence of this an indifferent body is a physical impossibility; for a body in which the respective forces might be exactly equal and apposite when excited by a magnet of a certain strength would, upon lowering the power of the magnet below this standard, be attracted,—and by increasing the power of the magnet beyond this standard, be repelled.

During a previous investigation, the author of the present memoir had repeated opportunities of observing phenomena exactly similar to some of those which form the premises of Plücker's conclusion; and a close study of the subject convinced him that to account for these phenomena the hypothesis of two conflicting forces in the same compound mass, the one or the other of which predominates according as the power of the magnet is increased or diminished, was by no means necessary.

To fit himself for the investigation of this question, he commenced an inquiry last November into electro-magnetic attractions; one of the results of this inquiry was, that a sphere of soft iron separated from the end of a straight electro-magnet by a small fixed distance, was attracted by the latter with a force exactly proportional to the square of the exciting current. Now, this attraction is in each case the product of two factors, one of which expresses the magnetism of the magnet, and the other the magnetism of the ball: and it is easy to see, that while the attraction increases as the square of the current, the magnetism of the ball increases in the simple ratio of the current itself. Our way to a comparison of magnetic attraction and diamagnetic repulsion is now clear. We know the law according to which the magnetism of the iron ball increases, and we have only to inquire whether the diamagnetism of the bismuth ball follows the same law.

The apparatus used in the former case proved, however, to be totally unfit for the measurement of diamagnetic force,—the feebleness of the latter rendered a much more delicate mode of measurement necessary. The torsion balance was the instrument finally resorted to by the author. A loop of paper was attached to one end of a fine silver wire, and in the loop rested a little beam of light wood. At the ends of the beam, which was six inches long, two spoon-shaped hollows were worked out, in each of which a ball of the substance to be experimented with might be placed. Two cones of soft iron, surrounded by helices of copper wire, were placed at right angles to the beam when horizontally suspended, the one cone facing the ball at one end, and the other cone facing the ball at the other end. The silver wire was carried upward through a tube three feet in length, and was connected at the top with a torsion head. When the cones were excited, by sending an electric current through the surrounding helices the balls were repelled. The index of the torsion head was then gently turned against the repulsion until the balls were brought within $\frac{1}{12}$th of an inch of the ends of the respective cones. The torsion necessary to effect this is evidently the expression of the repulsive force exerted at this particular distance. The strength of the exciting current was measured by a galvanometer of tangents, and it was regulated by means of a rheostat. The cones were excited by currents which varied from 10° to 57°, and the corresponding repulsions were detrmined. Spheres of the following diamagnetic substances were used:—1. Bismuth of commerce; 2. Chemically

* *British Association*: from *The Athenæum.*

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pure bismuth obtained by dissolving the material of commerce in nitric acid, precipitating it with distilled water, washing the precipitate for six days successively, and reducing it by means of black flux; 3. Sulphur of commerce; 4. Spheres from a crystal of native sulphur obtained in Sicily; 5. Calcareous spar from Clitheroe; 6. Calcareous spar from Andreasberg, in the Hartz mountains, Germany.

In all these cases the diamagnetism of the spheres followed precisely the same law as the magnetism of the sphere of soft iron:—it was exactly porportional to the exciting current.

These results cannot be reconciled with the statemen that diamagnetism increases with the increasing power of the magnet in a much quicker ratio than magnetism.

The experiments of Plücker might be accounted for in many ways, but such explanations, being necessarily conjectural, may be omitted here. It is known that crystalline bodies suspended between the poles of a magnet exhibit phenomena which are absent in the case of amorphous bodies. A certain line through the crystal will take up a certain determinate position; and if this line be forcibly moved away from this position, when the force is removed it will return to it. Thus a crystal of pure carbonate of lime suspended by a silk fibre between the poles with its optic axis horizontal, will always turn until the optic axis is perpendicular to the line joining the poles, in which position it will come to rest.

This fact was discovered by Plücker, who referred it to the operation of a new force which was entirely independent of the magnetism or diamagnetism of the mass of the crystal.

In an investigation conducted by the author in companionship with Professor Knoblench, of Marburg, this hypothesis of a new force is rejected; and it is there shown that the position of the optic axis, so far from being independent of the magnetism and diamagnetism of the mass, is entirely changed if a magnetic constituent be substituted for a diamagnetic. Thus, for instance, carbonate of iron differs from carbonate of lime only in the fact that in the former case an atom of iron is substituted for an atom of calcium. The crystalline form in both cases is identical, the optic axis of carbonate of iron sets nevertheless from pole to pole with an energy far surpassing that with which the optic axis of carbonate of lime sets perpendicular to the line joining the poles.

But why is it that one direction in the crystal takes up a particular position? The torsion balance gives a prompt answer to this question. A sphere of calcareous spar was placed upon each of the spoon-shaped hollows of the beam, the direction of the optic axis through each sphere being carefully marked. The spheres were first placed so that the optic axes were parallel to the axes of the soft-iron cones,—and secondly, perpendicular to the same. The repulsion in the former case was to the repulsion in the latter in the ratio of 53 to 48. If a bismuth crystal be suspended between two poles, the plane of most eminent cleavage will always set perpendicular to the line joining the poles, that is, equatorial. A cube formed from this crystal was placed on each end of the little beam; first, so that the planes of principal cleavage were parallel to the axes of the cones; and secondly, perpendicular to them. The repulsion in the former case was to the repulsion in the latter in the ratio of 53 to 38.

The diamagnetic mass in both these cases is repelled with a greater force in one direction than in any other direction. When the crystal is suspended between two poles, the line which marks the direction of maximum repulsion recedes as far as possible from the poles, and hence sets equatorial. A result the exact antithesis of the above was observed with magnetic crystals. A cube of sulphate of iron was attracted in one direction by a force of 43, and in another direction by a force of 36·3. A sphere of carbonate of iron was attracted in the direction of the optic axis by a force of 43, and in a direction perpendicular thereto by a force of 30·5. When these crystals are suspended between two poles, these lines of chief attraction approach the poles, and finally set axial. Thus we see that the peculiar phenomena exhibited by crystals in the magnetic field are to be referred to a modification of magnetism or diamagnetism brought about by the peculiar structure of the crystal.

Let us endeavour to penetrate this mystery of structure.

Our next inquiry is—What direction is that which is chosen by the respective forces for the manifestation of their greatest energy? To this question the author imagines that a full and intelligible reply is returned by experiment. If the arrangement of the component particles of any body be such as to present different degrees of proximity in different directions, then the line of closest proximity (other circumstances being equal) will be that of strongest attraction in magnetic bodies, and of

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strongest repulsion in diamagnetic bodies. The torsion balance furnishes us with the means of submitting this conclusion to a direct test.

A quantity of bismuth was ground to dust in an agate mortar, gum-water was added, and the mass was kneaded into a stiff paste. This was placed between two glasses and pressed together. From the mass when dried two cubes were taken, the line of compression being perpendicular to two of the faces of each cube and parallel to the other four. Suspended by a silk fibre in the magnetic field, upon closing the circuit the line of compression turned strongly into the equatorial position, exactly as the plane of most eminent cleavage in the case of the crystal. The cubes were placed one upon each end of the torsion balance, first with the line of compression parallel to the axis of the cones, and secondly perpendicular thereto; the repulsion in the former case was to the repulsion in the latter in the ratio of 53 : 30. A greater differential action was thus exhibited in the case of the model than in the case of the crystal. A pair of cubes constructed in the same manner from powdered carbonate of iron exhibited an analogous predominance of attraction in the line of compression.

Against this mode of experiment an objection was urged during the meeting of the British Association at Edinburgh last year by Professor William Thomson, of Glasgow. "You have," he said, "reduced the mass to powder, but you have not thereby destroyed the crystalline form; your powder is a collection of smaller crystals,—and the pressing of the mass together gives rise to a predominance of axes in a certain direction, so that the repulsion and attraction of the line of compression which you refer to closeness of aggregation is after all a product of crystalline action. Besides, we know that compressed isinglass exhibits the same optical phenomena as crystals, and you are unable to prove that the action is not due to a *quasi* crystalline structure induced in the gum by compression."

The following experiment will set this point at rest. It will not only show the influence of compression apart from the mere arrangement of the axes or from the influence of the gum, for none will be used; but it will also demonstrate the total nullity of this presumed axial force where opposed to the influence of compression.

To this experiment I was conducted by the following accident. The investigation was conducted in Berlin, and the great electro-magnet of the University was beside me at the time. Some notion of the power of this magnet may be gathered from the fact, that the copper helices alone which surrounded the iron pillars which composed the magnet weighed 243 pounds. On the top of the pillars two moveable masses of soft iron were placed, each weighing about 25 pounds, and between these the substance to be examined was suspended. Before I had thoroughly made the acquaintance of the instrument I hung a fine cube of bismuth crystal between these moveable poles: on closing the circuit the planes of most eminent cleavage receded to the equator. Scarcely, however, was this attained when I observed the poles moving towards each other, and before I could break the circuit they had rushed together and clenched their iron jaws upon the crystal. The latter was reduced by the pressure to about three-fourths of its primitive thickness, and it immediately occurred to me that if the theory of proximity were true it ought to tell here. The pressure brought the particles of the crystal more closely together, and hence a modification, if not an entire reversion, of the former action might be anticipated. Having liberated the crystal, I boiled it in hydrochloric acid, so as to remove any impurity it might have contracted by contact with the iron. It was again suspended between the poles, and completely verified the foregoing anticipation. The line of compression, that is, the magnecrystallic axis of the crystal, which formerly set from pole to pole, set now equatorial. The experiment was then repeated with a common vice; various pieces of bismuth protected by plates of copper were placed within its jaws, and there pressed to the thickness of a shilling. The plates thus obtained when suspended from their edges in the magnetic field exhibited one unvarying result:—the line of compression stood always equatorial, and it was a matter of perfect indifference whether this line was the magnecrystallic axis or not. In these cases no gum was used, and not only was a predominance of axes present, but they all worked together; they were further assisted by the great mechanical advantage offered by such plates to diamagnetic repulsion; the line of compression nevertheless triumphed over all and determined the position of the crystal.

The author concluded his paper as follows:—

"Whoever denies the influence of proximity will have to answer the following questions:—How is it possible that a greater differential action can be exhibited

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by a cube of bismuth dough than by the crystal itself? What is it which causes the magnecrystallic axis to forsake its usual position and to set equatorial when the crystal is compressed in the direction of that axis? He must further assume a crystalline structure on the part of wax, flour, shale, and the pith of fresh rolls; for in all these substances the line of compression determines the position of the mass in the magnetic field.

Professor Faraday rose, and spoke at some length on the valuable contribution to science which had been brought before them by Dr. Tyndall. It afforded him great gratification that there was one at least among us who had followed up this important subject so perseveringly. The beautiful laws established by Dr. Tyndall proved the identity of magnetism and diamagnetism in one important particular,—a result which he always anticipated; and if the crystalline action could be explained by what might be called the gross mechanical experiments brought before them, the discovery was one of the utmost consequence. It gave him pleasure to be able to propose a question to one who had worked so long at the foundations of this matter. Many philosophers had affirmed that it was possible to convert attraction into repulsion, and *vice versâ*, by merely varying the magnetic power: this was contrary to his own experience, and he wished to ask Dr. Tyndall whether he had ever met a case of the kind.

Dr. Tyndall stated in reply that he had diligently sought for such a case, but had never succeeded in finding it.

Professor Faraday felt prepared to admit that some of Dr. Tyndall's results seemed to promise an explanation of Plücker's perplexing results and conclusions; but for his own part he was anxious to keep his mind free from bias, to get well-established facts, and to free them as much as possible from all circumstances which could mark, disguise, or mislead in the interpretation of them,—and such being his fixed determination and settled habit, he was rather at a loss to remember to what portion of his publications on the subject Dr. Tyndall referred when he considered him to have considered the facts now brought forward as improbable.

NEW MODE OF ASSAYING NITRES.

BY DAVID ZENNER.

THERE are few assays that present so many difficulties as those of the alkaline nitrates. Among the many proposed, some are merely empyrical such as the method introduced by Schwarz for the use of the Swedish Government; others, as the method of Riffault, are not only troublesome, but give inaccurate results. Very few give correct results, and owing to their requiring several operations and some skill in chemical manipulation, are rarely used by manufacturers. I allude to those proposed by Gay-Lussac, Watt, and Pelouze. Those of the two last mentioned will ever be valuable to the chemist for the estimation of nitric acid alone or in combination.

The method I am going to propose is recommended not only for its accuracy, but also for the simplicity of its manipulation and the short time required for its performance. Its advantages have been fully tested in several manufactories in which it has been in use for upwards of two years.

The nitrates of the metallic oxides are for the most part easily decomposed by heat; I therefore thought it would be easy to estimate the amount of nitric acid, by the loss of weight of a mixture of the metallic oxide, combined with a strong stable acid with the alkaline nitrate when heated.

After many experiments, I ascertained that sulphate of lead answers the purpose best, because it is easily prepared, and when once dry, it is not very liable to absorb moisture. It readily exchanges its sulphuric acid with the nitric acid of the alkalies and the nitrate of lead formed, decomposes far below red heat.

In order to be better understood I shall first describe the mode of opertaion: I use a Dresden porcelain crucible about 1¼ inches wide at the bottom and the sides about 1 inch high, with a well fitting lid, which may be had of any dealer in chemical apparatus. After having ascertained the weight of it I introduce from ½ to 1 gramme of the nitre to be tested, put the lid on and heat until it fuses smoothly and without bubbles. The loss of weight is water, or when the amount of water is of no consequence, I only now weigh the nitre. It is necessary that the nitre be equally spread over the bottom of the crucible. The dry powdered sulphate of lead is then placed on the nitre amounting to about 8 to 10 times its weight. The crucible is again weighed and placed over the lamp for about 10 minutes; as soon as the crucible becomes hot, the red colored fumes of nitrous acid are seen to escape from under the lid; when this has ceased and no more can be detected by the smell the lid is lifted; sometimes there are still some

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nitrous vapors in the crucible; in this case the heat is continued a little longer, but after a few trials the proper temperature and the length of time are easily found.

After cooling, the crucible is weighed and the loss of weight will be found equal to the nitric acid contained in the nitre. The following experiments were made with pure substances:

	I	II	
	Grms.	Grms.	100ps.
KO NO^5 used.....	1·000	1·137	
Loss by heat = water..	008	007	60
heated after adding the sulphate of lead which represents	=530	603	53·03
KO,NO^5.....	99·24		99·30
Theory requires.....	99·20		99·40

It remained to be ascertained whether the chlorides which are rarely absent in commercial nitrates would act disadvantageously, as chloride of lead is volatile when heated with the access of air. I found that it is better to exclude the air as much as possible and when this caution was observed and the lid lifted no oftener than is necessary, the result was the same as in the above experiments:

	I	II
	Grms.	
NaCl used.....	5305	5465
KO NO^5.....	3395 NaO NO^5	5036
Loss by heat=Water..	003	0300
Addition of sulphate of lead & heated lost	179	3000
Represents KO NO^5...	3355 NaO NO^5	4729
Loss.....	0010	0006

I need scarcely say that any sulphates which may be contained in the nitrates have no influence on the accuracy of the method nor have the earthy matters. When the amount of impurities exceeds 5 per cent. it is better to mix the substance to be tested with about 4 or 5 times its weight of sulphate of lead in a small mortar, and after having removed the mixture into the crucible rinse the mortar 2 or 3 times with small quantities of the reagent and giving it on the top of the first in the crucible.

I must here observe that I have never been able to obtain as correct results when I placed the nitre on the sulphate of lead.

The temperature should never rise to a red heat, as it injures the crucible, and makes the cleaning of it difficult; but when the nitrate is very impure, a little longer time must be allowed.

The crucible is cleaned by steeping it in water containing some nitric acid, and it is curious to observe that there is always a hollow space under the sulphate of lead where the nitre has been. The nitre, it seems, is attracted when fused by the porous sulphate of lead, and in creeping up it is decomposed. The sulphate of lead for use is prepared by one of the usual methods, and when dry, it is heated in a crucible until it just begins to contract (not fused) after being allowed to get nearly cold it is powdered and kept in a bottle.

CHEMICAL RESEARCHES ON THE SOFT ROE OF THE CARP.*

BY M. GOBLEY.

In my former memoir (See THE CHEMIST, Vol. I, New Series, pp. 483—527,) I had the honor of bringing before the Academy the result of my researches on the chemical composition of the eggs of fish. It appeared to me interesting to join to this study the examination of the prolific liquor of the male, and thus to complete in a chemical point of view, the study of the substances which concur in the reproduction of this class of vertebrate animals. This is the object of the memoir which I now present to the Academy.

Fourcroy, Vauquelin and John, appear to be the only chemists who have made any researches into the soft roe of fishes. Fourcroy and Vauquelin proved, in 1807, that the soft roe of the carp contained water, gelatine, albumen, some salts and a phosphuretted fat which they regarded as an animal soap. In 1814, John ascertained, like Fourcroy and Vauquelin, that it contained water, gelatine and albumen, salts and a white fat, but he noticed, besides, the presence of a large quantity of phosphate of ammonia, and concluded from his experiments, contrary to the specimen of Fourcroy and Vauquelin, that the fatty matter of the roe of the carp did not contain *substantial* phosphorus. Further researches were therefore necessary for clearing up this very important point; those which I now communicate have reference to the the soft roe in general, and especially to its fatty matter, in which I have observed the remarkable fact that it is analogous, in composition, to the viscid matter of the yolk of the fowl's egg and of the egg of the carp, and particularly to cerebral fat. The analogy of its composition and properties, to the last-named substance is truly remarkable. Having devoted myself completely to chemical researches, I will not risk any opinion of

* *Journal de Pharmacie*, June, 1851.

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my own as to the part which the soft roe may perform in a physiological point of view. I will only mention, as a curious coincidence, that MM. Dumas and Prevost imagined, long ago, that the fecundising fluid is destined to constitute the nervous system of the young animal. They have already gone so far as to seek in the form of the spermatozoïd the rudiment of the form of the cerebro-spinal axis. Whatever may be the part performed by the fecundising matter, I must notice this chemical relation between its composition and that of cerebral matter. I leave physiologists to draw the conclusion.

The bodies which I extracted from soft roe are:—

1. Water.
2. Albuminous matter.
3. Lecithine.
4. Cerebrine.
5. Cholesterine.
6. Oleïne and margarine.
7. Extract of flesh.
8. Salts, such as chlorides of sodium and potassium, hydrochlorate of ammonia, sulphate of potassa, and phosphates of potassa, lime, and magnesia.
9. An odorous principle.
10. A peculiar membranous or glandulous substance.

The roe, as proved by Fourcroy and Vauquelin, is neither acid nor alkaline; by boiling it in water, an acid is produced which has a great analogy to lactic acid

The estimations of the constituent principles of the soft roe were made during the month of May, at which period this organ is filled with a great quantity of fecundising liquid.

I have repeated most of my experiments on the soft roe of the herring, and I arrived at the same results.

I have not detected in the soft roe the presence of volatile fatty acids.

WATER.

To determine the proportion of water which the roe contains, I first heated it on a sandbath, taking care to keep it continually stirred; but as after a short time it formed a soft, glutinous mass, like coutchouc, I placed it on a stove heated to from 230° F. to 248° F., until it lost no more in weight.

I ascertained by this means that the soft roe contains about three-fourths of its weight of water. 100 parts lost by desiccation, 74·805 of water.

ALBUMINOUS MATTER.

The roe was divided in water, which gave it the appearance of an emulsion. When the whole was thrown on a filter, an opalescent liquid flowed out which coagulated at a temperature of about 160° F.; the liquid contains, therefore, an albuminous matter. The quantity of liquor which passed through the paper was very small, so that I was unable to obtain sufficient albumen for examination. I ascertained, however, that it contained sulphur, and that it dissolved in hydrochloric acid, communicating to it a violet color. It seemed to me, moreover, that this substance existed only in very small quantity in the liquid of the roe, and that the greater part of the residue left by alcohol when made to act on this organ was formed of a peculiar body which was divided in water and could not be separated from it by filtration.

I could not estimate the albuminous substance, but I proved that the fluid of the roe, when heated with boiling alcohol, leaves a residue whose weight amounts on the average, the salts being deducted, to 20·242 per cent.

LECITHINE AND CEREBRINE.

The proportion of fatty matter which the soft roe contains is not very considerable; to obtain it, the fluid of the soft roe is deprived of a portion of the water it contains; it is then put, after being divided, in contact with ether, which dissolves the greater part of the fatty substance, but as it does not separate the whole of it, the residue of the first operation is treated several times with boiling alcohol. The filtered alcoholic liquid is then reduced to a small bulk, and agitated in a flask with ether, to separate the fatty body from the aqueous liquid which contains the salts; 100 parts of the fluid portion of the roe give on the average 3·506 of fatty matter.

This substance is colorless or yellowish; it is semi-transparent, and has a viscid but very firm consistence, and a fishy odor. It has no action on litmus, when pure solvents have been employed for obtaining it. It behaves under the influence of heat and water like that of the eggs of the carp. When a mixture of fatty matter and water is boiled for twelve hours, the liquor, after that time, does not possess a perceptibly acid reaction. The fatty substance is physically modified, it is true, and appears inclined to liquify, but it is not decomposed; neither phosphoric nor phosphoglyceric acid, nor neutral fatty bodies, nor fatty acids were produced; by repose it deposited on the bottom of the capsule.

It dissolved in ether, having a slight residue of cerebric matter. Alcohol at 88° C.

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dissolved it only with the aid of heat, abandoning, however, a small quantity of oleine and margarine, united to a small quantity of cerebric substance.

The mineral acids and alkalis exert on the fatty substance of the soft roe an action analogous to that which they give rise to on the viscid matter of the yolk of the fowl's egg, and the eggs of the carp.

When 6 grammes of fatty matter are mixed in a mortar with 60 grammes of water containing 2 gr. of potassa, an emulsion which leaves no deposit is formed. After 24 hours' contact, if this emulsion be heated on a sandbath for half an hour, no apparent phenomenon takes place; by the addition of acetic acid no fatty matter rises to the surface. If the mixture be boiled for some time, on decomposing it with acetic acid, and throwing the whole on a filter, it is ascertained that the liquid which flows out contains phosphoglyceric acid, or phosphoric acid and glycerine. With regard to the soft and whitish substance remaining on the paper, it is perceived, on dissolving it in boiling alcohol, that it contains oleic and margaric acids.

6 gr. of fatty substance were divided in 50 gr. of water, acidulated with 3 gr. of hydrochloric acid, and left in contact for 24 hours. The mixture formed of a thick emulsion, of a greyish color, which was heated on a sandbath for half an hour; there was no perceptible decomposition. I then boiled it; the matter increased much in volume; after a contact of half an hour, I allowed it to cool. There was perceived on the surface of the liquid, cholesterine, margaric acid, and oleic acid, whilst the cerebric matter was infinitely divided under the form of black points. Sometimes the cerebric matter had not undergone sufficient modification, and then the upper layer was soft and viscid, but it was easy to perceive, in treating it with boiling alcohol, that it contained fatty acids.

The aqueous liquid contained phosphoglyceric acid. By saturating the acid liquor with lime, evaporating the filtered liquor, and precipitating by alcohol, it was found that the deposit was formed of phosphoglycerate of lime combined with a small quantity of chloride of calcium.

As in the cases of yolk of egg and the eggs of the carp, alcohol facilitates the decomposition of the fatty matter of the soft roe by the acids and alkalis.

6 grs. of fatty matter were divided in a mortar in 60 gr. of alcohol at 85° C. containing 2 gr. of potassa. After from 24 to 36 hours, a whitish deposit was formed, in a yellow alcoholic liquid. It is known that in these conditions the viscid matter of the yolk of the fowl's egg and of the eggs of the carp dissolves completely.

This deposit was formed of a small quantity of albuminous matter, of a small quantity of fixed oil, of cerebric matter, and especially of cholesterine. Indeed, by treating it with boiling alcohol and filtering the liquid, chlolesterine was obtained crystallised in very large plates.

As regards the liquor, when decomposed by a slight excess of acetic acid, there floated on it, after cooling, a white, light, crystallised substance, and a liquid of oily appearance.

It was filtered through previously moistened paper, in order to separate the fatty matter from the aqueous liquid. It was easy to ascertain, by treating it with boiling alcohol, that it was formed of margaric acid, oleic acid, and a small quantity of cholesterine; the cerebric matter seemed to have disappeared, but, in this case, it was only very finely divided, and it modified the crystalline from the margaric acid and cholesterine.

The aqueous liquor contains phosphoglyceric acid, or phosphoric acid and glycerine, for it is known with what facility this acid is decomposed, under the influence of the alkalis, into phosphoric acid and glycerine.

10 gr. of fatty matter were, as before, divided in 60 gr. of alcohol, with the addition of 5 gr. of hydrochloric acid. After 12 hours' contact, a soft viscid deposit was formed, which had a sort of micaceous aspect. It was heated on a sandbath, and slowly raised to the boiling temperature; all was dissolved with the exception of a slight fatty and viscid residue; it was cooled in a test-glass; there floated in the liquid a great quantity of brilliant and micaceous lamellœ, which were received on a filter, and which were cholesterine, mixed with a little albuminous matter, carried along with it, and which it was easy to separate, by means of boiling alcohol.

When the filtered liquid was left to itself, an oily matter floated on it which, collected, gave by repose, a soft substance of a white color, which was no other than cerebrine; the liquid fatty body was of the same nature as that which is obtained in the same circumstances from the viscid matter of the yolk of the fowl's egg and from the eggs of the carp.

The aqueous liquid which had been deposited from the fatty matter just mentioned contained phosphoglyceric acid.

In the flask which had been used in

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these reactions, was formed a soft substance of a fatty nature, and of a brownish color. It yielded cholesterine to boiling alcohol; then, put in contact with ether, it was dissolved, leaving a considerable deposit of phosphate of lime. By evaporation the ether gave a fatty matter which was formed of oleine and margarine, and to which I shall refer further on.

It cannot be doubted, from the experiments I have just mentioned, that the fatty substance of the soft roe is formed of the same principles as the viscid matter of the fowl's egg and of the eggs of the carp. We have found in it, indeed, cerebrine, cholesterine, fixed oil and oleic, margaric and phosphoglyceric acids, which are the products of decomposition of the substances to which I have given the name of lecithine.

The fatty matter of the soft roe presents a greater resistance than that of the eggs of carp to the action of the acids and alkalis; the reactions are neither so clear nor so decided on account of the presence of a larger proportion of cholesterine and cerebrine. It appears also that when the action of the acids, and especially that of the alkalis, is continued for a long time, phosphoglyceric acid, which is, as is known, a rather unstable body, is partly or entirely decomposed, and we find in the liquor less of that acid, or only phosphoric acid and glycerine. Moreover, fatty acids are always obtained, and never neutral fatty bodies.

The crystalline forms of cholesterine and margaric acid are often also modified by the presence especially of cerebrine; but by means of alcohol containing potassa, or acidulated water, or by solution in alcohol, it will always be easy to recognise the presence of these various bodies. It is therefore unnecessary, in experimenting on the fatty matter of the soft roe, to be on our guard against these causes of error.

Lecithine and cerebrine are found in soft roe, as in the yolk of egg and in the eggs of carp, simply united, like most organic matters, with the phosphate of lime and magnesia. In yolk of egg it is easy to prove it; it is sufficient, indeed, as we have said, to exhaust these bodies, with boiling water, of all their soluble salts, and to remove the fatty matter by means of ether; but with the soft roe, we cannot act in the same manner; it forms with water a magma from which it is impossible to separate the liquid exactly; I was, therefore, obliged to have recourse to a different means. The process which I employed is the same as that I used for determining if the fatty matters of the brain were combined with soda; it requires much time, but with patience, we are enabled to separate from the fluid of the soft roe all the soluble salts which it contains. The following is the mode of operating:

A certain quantity of soft roe is taken—several hundred grammes; the membranes and blood adhering to it are separated as much as possible, and it is then cut into thin slices. The divided substance is then introduced into a flask with distilled water, agitated, boiled, and the whole thrown on a filter; the liquid which runs out carries with it a large portion of the salts. When no more separates, the residue is placed in a flask with rectified alcohol at 88° C., boiled and poured on a filter. The matter when well drained is returned to the flask, with alcohol at 56° C.; this treatment is repeated a great number of times, until, at length, the liquid no longer leaves any saline residue by evaporation.

Weak alcohol presented to me the advantage of dissolving the salts without separating a considerable quantity of fatty matter.

By drying the product of all these operations, and by treating it with ether or alcohol, a fat is obtained which contains neither potassa, soda, nor ammonia. It is necessary, as I have said, to repeat the alcoholic treatment a great number of times, to deprive the soft roe of its soluble salts, the chloride of potassium and the phosphate of potassa which it contains being sparingly soluble in weak alcohol.

It is ascertained that the fatty substance thus obtained contains neither potassa, soda, nor ammonia by decomposing it with water acidulated with hydrochloric acid; the fatty matter is separated by receiving it on a previously moistened filter, and the aqueous liquor is evaporated and the residue calcined. A very acid charcoal is obtained which contains much phosphoric acid; it is put in contact with an excess of lime-water prepared with lime produced from statuary marble, and very pure distilled water; the phosphate of lime is separated by filtration and the liquid is evaporated and leaves no perceptible residue. The fatty matter of the soft roe does not exist, therefore, in that organ, in the state of a soap.

(To be concluded in our next.)

ON THE NEW METAL—DONARIUM.* Dr. FARADAY read extracts from a letter

* *British Association.*

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by Professor Bergeman, of Bonn, and exhibited a specimen of Orangite, the mineral affording the new metal Donarium, which was stated as easily to be reduced by potassium and sodium, in preference to reduction by the gas hydrogen; and as fear had been entertained for the perfect preservation of the properties of the new metal if exposed to the chances of a sea voyage, as it readily tarnishes and oxidises, the discoverer had thought it more expedient to send a specimen of the hydrated oxide of Donarium.—In allusion to the statement that Professor Rose had repeated and confirmed these results, Dr. Faraday expressed an opinion that chemists had of late years viewed with regret the increase in the number of metals, and hoped that the day was not far distant when some of the metals would afford honor to chemists by new modes of investigation leading to their decomposition.

OBSERVATIONS ON ATOMIC VOLUMES AND ATOMIC WEIGHTS, WITH CONSIDERATIONS ON THE PROBABILITY THAT CERTAIN BODIES NOW CONSIDERED AS ELEMENTARY MAY BE DECOMPOSED.*

BY PROFESSOR DUMAS.

Professor Dumas alluded to the solubility of some substances and the insolubility of others, giving many instances of the difference of this quality in regard to solution in water, sulphuric and strong acids, and referred to Berthollet's views and experiments on this subject.

The measure or volume of bodies he thought might be represented with as much facility as the weight: thus, for example, magnesia and sulphuric acid may have their volumes numerically expressed before and after combination, and also graphically by lines. Magnesia with sulphuric acid showed a certain degree of condensation, lime a greater condensation, and barytes the greatest condensation; and these he could represent and reason on as well by lines of different lengths as by figures or by words.

The degree of condensation (however expressed) had also relation to the quality or degree of solubility. Thus, sulphate of magnesia was very soluble, sulphate of lime but little soluble, and the greatly condensed sulphate of baryta was insoluble.

He then pursued the analogy with the chlorides, comparing the chloride of sodium with the extreme case of the chloride of silver.

After graphically expressing the solubility of bases with sulphuric acid by lines, he proceeded to show that the relative volumes of the elements chlorine, bromine, and iodine could be perfectly represented by lines equal in length.

Professor Dumas said that when a number of metals are represented by lines, at first they seem in confusion, and it would appear like an impossibility to arrange them in a system of lines to permit their relations to appear; but when considered in relation to the substitution of one property for another, or of the substitution of one substance for another in groups, then their arrangement became easy.

And here we may remark, that Professor Dumas had not previously prepared diagrams or tables, but covered a large black board with lines, figures, and formulæ, to follow his train of reasoning,—and symbols, volumes, and names were rapidly produced and as rapidly effaced to illustrate the Professor's views of the laws of the substitution of one body for another in a compound.

Professor Dumas gave many examples of groups of bodies, such as the alkalies, earths, &c., arranged in the order of their affinities. He called attention in the Triad groups, to the intermediate body having most of its qualities intermediate with the properties of the extremes, and also that the atomic or combining number was also of the middle term, exactly half of the extremes added together; thus, sulphur 16, selenium 40, and tellurium 64. Half of the extremes give 40, the number for the middle term. Chlorine 35, bromine 80, and iodine 125. Or the alkalies, lithia, soda, and potassa, or earths, lime, strontia, and baryta, afforded, with many others, examples of this coincidence; hence the suggestion, that in a series of bodies, if the extremes were known by some law, intermediate bodies might be discovered; and in the spirit of these remarks, if bodies are to be transformed or decomposed into others the suggestion of suspicion is thrown upon the possibility of the intermediate body being composed of the extremes of the series, and transmutable changes thus hoped for.

Professor Dumas then showed that in the metals similar properties are found to those of non-metallic bodies; alluding to the possibility that metals that were similar in their relations, and which may be substituted one for the other in certain com-

* *British Association*; from *The Athenæum*.

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pounds, might also be found *transmutable* the one into the other.

He then took up the inorganic bodies where substitutions took place which he stated much resembled the metals.

After discussing groups in triads, Professor Dumas alluded to the ideas of the ancients of the transmutation of metals and their desire to change lead into silver and mercury into gold; but these metals do not appear to have the requisite similar relations to render these changes possible.

He next passed to the changes of other bodies,—such as the transmutation of diamonds into black lead under the voltaic arc.

After elaborate reasoning and offering many analogies from the stores of chemical analysis, Professor Dumas expressed the idea that the law of the substitution of one body for another in groups of compounds might lead to the transformation of one group into another at will; and we should endeavour to devise means to divide the molecules of one body of one of these groups into two parts, and also of a third body, and then unite them, and probably the intermediate body might be the result. In this way, if bodies of similar properties and often associated together were transmutable one into the other, then by changes portions of one might often, if not always, be associated with the other. Thus, in nature when chlorine occurred, iodine and bromine might also be found, and always would be if they were transmutable the one into the other. Cobalt is thus mysteriously associated with nickel, iron with manganese, sulphur with selenium, &c. In the arts during operations when certain radicles were produced, analogous ones were found constantly to be associated. In the distillation of brandy, oil of wine is always an associated result.

Dr. Faraday expressed his hope that Professor Dumas was setting chemists in the right path; and although conversationally acquainted with the subject, yet he had been by no means prepared for the multitude of analogies pointed out.

Mr. Grove spoke of the importance of the view; as, by knowing the extreme compounds, it might serve as a guide in experiments and as a check to the results. He adverted to the allotropic condition of substances when their principal characters were changed but their chemical qualities were unaltered; thus, carbon in the state of diamond had a change of property so complete that it had one of the properties of metals given or transferred to it by its conducting power for electricity under these conditions, and its other forms were states resistant to electric passage. He thought this fact of certain bodies having two sets of physical properties with greatly differing character might with this law of the substitution of one set of chemical qualities for another in a compound group, give the hope of the great realization of some of the ideas embodied in the views of the possible transformation of one body at will so as to possess the properties of others.

Professor Williamson, Dr. Anderson, and Dr. Gladstone remarked on these analogies, and referred to the groups of bodies of similar characters, but whose history was difficult or inexplicable. Thus, the metals of the platina group of bodies, the red states of phosphorus and of sulphur, the carrying of certain of these properties into the sulphurets of phosphorus, and the unsatisfactory history of bodies like the phosphates, might be rendered clear in future researches by the ideas resulting from numerous examples of the triad groups alluded to by Professor Dumas.

FURTHER RESEARCHES ON THE EXTRACTION OF OXYGEN FROM ATMOSPHERIC AIR.*

BY M. BOUSSINGAULT.

THE kindness with which the Academy received at its sitting of February 25, (see the CHEMIST, Vol. II, page 311) the account of the researches which I had undertaken on the extraction of oxygen gas from atmospheric air, induces me to-day to communicate to it some results which I think worthy of its attention.

The Academy will remember that I was unexpectedly led to prove this fact that notwithstanding the powerful affinity which unites its elements, hydrate of baryta is completely decomposed by a current of dry air at a red heat. The water is removed, and, in the place of the hydrate, baryta or binoxide of barium is obtained, according to the degree of heat at which the operation has been performed. Coupling this fact with another which has long been known, that water in ebullition suddenly changes the binoxide into hydrate, expelling all the oxygen constituting this peroxide, I thought that it might be possible to extract the oxygen from the air at a temperature so moderate, that independently of the advantage of economy of fuel, there

* *Comptes Rendus*, No. 22, June 2nd, 1851.

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would be nothing to fear from the destructive action of the baryta on earthen vessels and the diminution remarked in the aptitude of this earth for oxidation. Indeed, the decomposition of the hydrate and the oxidation of baryta takes place at dull red, and the disengagement of oxygen might be effected below this temperature, since it occurs at 212° F., when aqueous vapor is present.

Although the idea of making air act gradually on the hydrate, and water on the binoxide, rested on certain results, obtained many times in the course of these researches, I was on the point of abandoning it owing to the difficulties I met with in my first experiments, and which difficulties were owing chiefly to the extreme fusibility of the hydrate. The hydrate becoming liquid at a red heat, it was necessary to place it in a long silver boat which occupied the whole of the heated part of a porcelain tube; but the layer of binoxide formed on the surface of the bath, very soon opposed an obstacle to the action of the air, so that, when 100 grammes of matter are operated on, the oxidation is propagated only very slowly.

This inconvenience is remedied by intimately mixing the hydrate of baryta with hydrate of lime, or with magnesia, with the double object of preventing from flowing out, from forming a bath, and from presenting, on account of its division, a very great surface to the action of the air.

In order not to tire the Academy's attention with descriptions of apparatus, the details concerning which will be found in my memoir, I will confine myself to saying that the mixture is introduced into a porcelain tube, taking the precaution of stopping it at each end with a stopper of asbestos. We then proceed to the oxidation by means of a very rapid amount of air, for, as may be imagined, the hydrate of baryta is decomposed so much the more rapidly, as the air comes into it with greater rapidity. The peroxidation being considered sufficient, the communication is established with a gasometer; then by means of a small boiler arranged for the purpose, a jet of steam is directed into the tube; the hydrate is immediately reconstituted and the oxygen disengaged; the baryta of the hydrate is afterwards oxidised by the air and deoxidised by water successively.

We have here perhaps an example of the influence of masses on chemical affinity. Thus, in this case, a large quantity of air would remove, by means of the oxygen it contains, the water from the hydrate of baryta to form binoxide; in the other, at the same temperature, it would be a continued current of aqueous vapor which would drive the oxygen from the binoxide to constitute the hydrate of baryta.

The low temperature at which the two opposite actions which I have just described take place, would lead us to presume that the baryta would retain its aptitude for oxidation; and this appears to be the case if we may judge from several results obtained by submitting during equal times, the same matter to the action of a rapid current of air.

ON NITRO-GLYCERINE AND THE PRODUCTS OF ITS DECOMPOSITION.

BY DR. DE VRY.*

THIS yellow liquid, nitro-glycerine, seems not to be poisonous, but it explodes at a moderate heat, as was shown by experiment, detonating when the drops of nitro-glycerine on paper were struck a smart blow with a hammer.

From the conversation in the Section, nitro-glycerine appears, like gun-cotton, to have states of apparent inactivity, which are removed by spontaneous causes:—for preparations that resist a certain amount of force applied at one time may readily explode soon afterwards.

ON THE GROWTH OF PLANTS IN VARIOUS GASES, ESPECIALLY SUBSTITUTING CARBONIC OXIDE, HYDROGEN, AND LIGHT CARBURETTED HYDROGEN FOR THE NITROGEN OF THE AIR.†

Dr. GLADSTONE gave the results of experiments made, and still in progress, in conjunction with his brother, Mr. G. Gladstone. After describing the effects on some flowers, as the pansy, the crocus, &c., a discussion ensued, and Mr. R. Warrington suggesting that in such experiments the plants be allowed to take root well before immersing in the gases; next, that the combined atmospheres were too much saturated with moisture, often causing rapid growth and decay,—and that these flowers and roots should be compared with others grown in similar volumes of confined common air.

Professor Dumas spoke of the great and, indeed, almost unsuspected influence of carbonic oxide gas. The judicial investigations in France had disclosed the fatal

* *British Association.* † *Ibid.*

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effects of this gas as being so much greater than carbonic acid gas. In the atmosphere produced by the burning of charcoal $\frac{1}{500}$ part of carbonate oxide was fatal, while with one-third the volume of carbonic acid the animal was asphyxiated, but afterwards revived.

The Chairman said that he had reason to believe that in the combustion of anthracite, much carbonic oxide gas is produced.

ON SOLID AND LIQUID CAMPHOR FROM THE DRYOBALANOPS CAMPHORA.*

BY PROFESSOR DE VRY.

DR. DE VRY gave the history of the rarer species of camphor from Sumatra and Borneo, the price of which is thirty to forty times greater than that to be met with in commerce, and after quoting from the work 'De Kamferboom van Sumatra' of W. H. de Vriese, of Leyden, and the opinions of Berzelius and Pelouze as to the composition, gave his experiments that led to his opinion that the fluid camphor or oil of camphor was rather to be regarded as a balsam than as an oil, and that the whole subject of the camphors deserved attention to clear up the obscurity of their history.

ON THE PREPARATION OF URIC ACID WITH THE EXCREMENTS OF BIRDS.†

BY M. LANDERER.

Cathartes ferinopterus is the name of the great eagle which the Egyptians called the Egyptian or holy eagle. This veneration of the ancients was owing to this bird having greatly contributed to the removal of dead animals, on which it lived, and because, in numerous flocks, it ordinarily accompanied the caravans in the desert, in order to devour stray cattle. On the banks of the Nile, this eagle, attracted by the putrid odor of dead animals, readily discovers the bodies of crocodiles which infect the atmosphere and produce the serious diseases with which that country is afflicted.

This same bird is found in Greece, but the *Gypactes barbatus*, *aquila fulva*, *aquila ossifraga* and *vultur fulvus*, are more common. These carnivorous birds are very much dreaded on account of the damage which they occasion to the shepherds, who pursue them and endeavour to destroy them by all possible means.

The Greeks adopt a very simple and singular expedient for catching these birds and selling them alive. It is as follows:—As soon as the inhabitants of a village discover one of them, they expose the body of a small lamb or any other animal in the open country, but not far from one of those deserted huts or churches which we meet with in very great number in the country, and which are adapted for concealing easily the people required for this kind of thing. No sooner does the eagle perceive the animal exposed, than attracted by the odor exhaled from it, he pounces on his prey, tears it greedily, and feeds on it gluttonously until, surfeited, he tries, but in vain, to resume his flight; not being successful, he hopes to save himself by a precipitate course. At this moment the hunters, on the watch, issue from their retreat; they approach armed with long sticks, and endeavor to strike him on the head to stun him. When they have succeeded, they seize him, tie him up, and carry him to the market for sale.

I had collected a sufficient quantity of the excrement of one of these eagles to be able to extract uric acid from it. Of all known methods of preparing this acid, I prefer the following. For some years it has been acknowledged that borate of soda is one of the best means of dissolving uric acid; I have convinced myself by different experiments, that 4 grains of borate of soda in two ounces of water at 95° F., perfectly dissolve a considerable quantity of uric acid without any precipitate or turbidness being formed in the solution on cooling. It is perfectly well known, for this reason, that borax has not only been proposed as a substitute for carbonate of soda, but has been preferred to it, as a remedy both for gravel and for urinary concretions, as soon as chemical analysis has shown that the concretions existing in the bladder are composed of uric acid. M. Wetzlar has proposed the employment of borax not only internally in these diseases, but also in the form of injections. I employed borax for the extraction of uric acid from these excrements; boiled them with a solution containing two parts of borate of soda in 150 parts of water. The filtered solution was decomposed by hydrochloric acid. After some hours' repose, the acid separated in small and white crystals. This method is, I think, preferable to all the others, and principally to that with caustic potassa. I have thus prepared uric acid

* *British Association.* † *Ibid.*

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with the excrements of fowls, pigeons and daws, *stryx bubo*, *stryx brachyotus*, and *stryx passerina*.

ON THE CORROSION OF AN ALLOY, COMPOSED OF COPPER AND SILVER, IN SEA-WATER.*

BY AUG. A. HAYES.

SOME analyses I made some years since of sheathing copper, which had long resisted the action of sea-water, proved the presence of nearly ten-thousandth part of silver. It was found that even this small portion of silver sensibly modified the chemical relations of the metal, and observations had indicated that the quality for sheathing was improved.

Copper of this kind is frequently met with in commerce and is derived from the Chilian ores of copper, which although argentiferous, do not yield enough silver to render its separation œconomical.

An occasion offered for again examining this subject when the argentiferous native copper of Lake Superior was first refined and rolled by the Revere Copper Company, more than five years since and the results have lately been obtained.

Four suits of sheathing, for large merchant vessels, formed the subjects for observations the metal being of uniform, composition, as determined by assay of the clipping from many sheets. 2000 parts of the alloy contained 4 parts of pure silver, or the standard ton of this country contained 4 lbs. of silver.

A *proximate* analysis of this metal was also made and it proved to be pure copper, throughout the mass of which an alloy of silver and copper was evenly distributed, so as to form either a mixture or a compound alloy, in which one part of the copper is truly combined with the silver, and the other larger part simply combines with the alloy. This is a very common constitution of alloys in which two metals exist, without any metalloid occurring to disturb the simplicity of the union, and always indicates a careful purification of the metals

It was assumed as probable that the silver alloy would close the pores of the copper, which takes place with a tin alloy in bronze, and in a mechanical way confers durability. If however corrosion should take place, it must be in accordance with observed cases that the silver alloy would act as a negative element and the copper alone would be removed. How erroneous these inferences proved will be seen in the detail of the results.

The 'Chicora' was coppered Jan. 9, 1847, taking 7392 lbs. metal, which was fastened by bronze nails. She was employed in trade to China, and wore her copper so rapidly, that it was removed in March 1849, 2628 lbs. only remaining. In this case, the sheets, after the usual operations, had been consolidated by "cold rolling."

The 'Serampore' was coppered January 18, 1847, requiring 8,447 lbs. of "cold rolled" metal, secured by bronze nails. She sailed to China and home *via* Cape of Good Hope, and to the Pacific and home *via* Cape Horn, requiring new copper in March 1850. The weight of the remaining copper was not ascertained.

The 'Hamilton' was coppered October 22, 1847, requiring 7,706 lbs. metal, secured by bronze nails. The sheets used were in the ordinary or annealed state. This vessel was employed in the India trade, and wore out her copper in August 1849. The weight of the copper remaining was 3,086 lbs.

The 'Carthage' was coppered November 26, 1847, requiring 8,727 lbs. "cold rolled" metal, fastened by bronze nails. She was employed in the India trade, and her sheathing was destroyed in August 1849. The copper remaining weighed 5,810 lbs.

Omitting the case of the 'Serampore,' where the corrosion cannot be determined by weight, we have the loss in every 100 parts of the metal for the time of duration; thus—

The Chicora, twenty-seven months lost.....	64·45 per 100
The Hamilton, twenty-three months lost.....	59·95
The Carthage, twenty-one months lost.....	33·45

Allowing the same rate of corrosion, and taking the time as twenty-seven months for each—

The Chicora lost.....	64·45 in 100
The Hamilton lost.....	70·38 ..
The Carthage lost.....	43·00 ..

In the cases of the 'Hamilton' and 'Carthage' we perceive the influenc of the different processes of manufacturing the sheets on the durability of the copper. By the operation of "cold rolling" the surfaces of the sheets are rendered very compact, and in any corroding solution they bear a negative relation to the metal in the same sheets between these surfaces. Such copper is also always strongly negative to annealed copper in acid solutions, until

* Silliman's *Journal*, May 1851.

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the hardened surfaces are removed; it then loses this relation. The 'Hamilton' exhibits the greatest effect of sea-water action on the annealed alloy, while in the 'Carthage' the protecting influence of the hardening surface was exerted nearly to the time her copper was removed.

These observations establish the fact of the rapid corrosion of an alloy thus constituted, and show its entire unfitness for sheathing purposes.

The average duration of copper sheathing decreases slightly, as the requirement of greater speed in sailing is more urgent. Taking one hundred merchant ships, sailing on different oceans, the average duration now on American ships is three years.

On the point of the *kind* of corrosion following the exposure of the alloy to sea-water and air, the information obtained in these trials is of a definite character. Part of the sheets remaining, and an ingot of the copper from smelting a large quantity, were assayed; and the results showed that the same proportion only of silver remain as was originally contained in the alloy. The silver alloy, therefore, by taking the negative state in the mass of the metal, hastened its destruction, while its own form and condition were such, that it separated as the copper was corroded.

For the records of facts, and much assistance continued for years in connection with the subject of copper corrosion, I am indebted to the kindness of my friend Mr. J. Davis, Jun., Treasurer of the Revere Copper Company.

II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

OBSERVATIONS ON THE TEAS OF COMMERCE.*

BY R. WARRINGTON, F.C.S.

[THE importance of tea as an article of consumption and of revenue induces us to publish *in extenso* the following valuable observations of Mr. Robert Warrington, read before the Chemical Society at its meeting of the 19th of May, 1851. They have great claims on the attention of all concerned in the tea trade, and will possess considerable interest for the consumer, and guide the chemist in commercial examinations of tea.]

In my previous communication to the Society on this subject, in February, 1844,† I endeavored to show that there exist two distinct kinds of green tea, known in commerce as *glazed* and *unglazed;* that the former is colored by the Chinese with a mixture of Prussian blue and gypsum, to which a yellow vegetable coloring matter is sometimes added, while the latter are merely dusted with a small quantity of gypsom; that in the specimen of the so-called Canton gunpowder, this glazing or facing is carried to the maximum. I also mentioned, that I had never met with a sample of green tea in which the blue tint was given by means of indigo. Since the publication of that paper, I have been in communication with several parties of great experience in this subject, from whom I have received much additional information, which, with several experimental points of interest that have come under my own immediate observation, will form the subject of the present paper.

The first point to which I wish to call the attention of the Society is, the question of the blue coloring matter used by the Chinese for coloring the green teas being Prussian blue, because some doubts have been thrown on this subject from various quarters. Mr. Bruce thus states:* "The Chinese call the former (the Indigo) *Youngtin*, the latter (the sulphate of lime) *Acco*." Now I am favored with the opinion of Mr. J. Reeves on this point, whose knowledge and experience render him most competent to decide in such a case; he believes that indigo is *never* employed for coloring used on tea, that the term Youngtin, as used by Mr. Bruce, should be Young-teen, *foreign blue*, the name given by the Chinese to Prussian blue in contra-distinction to Too-teen, *native blue, or indigo;* this, I think, is very conclusive evidence, and shows that Mr. Bruce's statement was erroneous.

In another quarter a surmise has also

* *Quarterly Journal of the Chemical Society.*

† Memoirs and Proceedings of the Chemical Society, II, 73.

* Report on the Manufacture of Teas, &c., by C. A. Bruce, Aug. 16, 1839.

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been published on this same point. Mr. Fortune, in his entertaining work* on China, says, speaking of the ingredients used in dying the northern green teas for the foreign market, p. 201, "There is a vegetable dye, obtained from *Isatis Indigotica*, much used in the northern districts, and called Tein-ching, and it is not unlikely that it may be the substance which is employed;" again, at p. 307, "I am very much inclined to believe that this (the Tein-ching) is the dye used to color the green teas which are manufactured in the north of China, for the English and American markets." This question, however, I think is now satisfactorily settled, and the experimental evidence I had adduced of the material being Prussian blue of a darker or paler tint, placed beyond a doubt by a positive demonstration; for Mr. Fortune has forwarded, from the north of China, for the Industrial Exhibition, specimens of these materials, which from their appearance, there can be no hesitation in stating are fibrous gypsum (calcined), turmeric root, and Prussian blue; the latter of a bright pale tint, most likely from admixture with alumina or porcelain-clay, which admixture may account for the alumina and silica found as stated in my previous paper, and the presence of which was then attributed possibly to the employment of kaolin or agalmatolite.

Mr. J. R. Reeves, in a letter to my friend, Mr. Thompson, dated July 1, 1844, commenting on my paper, says: "Mr. Warrington's experiments have led him to correct results as to the substances used, which I know to be Prussian blue, gypsum (fibrous), and turmeric; the second being sulphate of lime; and the last, the 'yellow, or orange-colored vegetable substance,' which Mr. W. does not otherwise name. That the coloring is not intended as an adulteration, I feel quite sure. It is given to suit the capricious taste of the foreign buyers, *who judge of an article used as a drink by the eye instead of the palate.* You well know how little the London dealers, even now, like the yellowish appearance of uncolored green tea. The Americans, a few years since, carried the dislike even further than the English, and therefore the Chinese merchant had scarcely a chance of selling his tea unless he gave it a 'face' that would suit *their fancy*. The small quantity of the coloring matter used, must preclude the idea of adulteration as a matter of profit." Mr. J. Reeves states, "that in the East India Company's time, gypsum and Prussian blue were sometimes used upon hyson teas, Tien Hing using the first on his pale, bright hyson; Lum Hing, the latter on his dark, bright tea; but these were only in minute quantities just sufficient to produce an uniform face."

It is still a question of interest, which I before alluded to, whether the gypsum in its *calcined* state, is not used for the absorption of the last portions of moisture and allowing the tea the better to withstand the damp of the sea voyage. Through the kindness of Dr. Royle, I have received, since my last communication, a sample of green tea from the Kemaon district, in the Himalayas, which is quite free from any facing, as are also the green teas of Java, a large number of which I have had an opportunity of examining, and which are exceedingly clean and genuine in their appearance and characters.

ON BLACK AND GREEN TEAS.

Although the prepartion of green and black tea from the respective plants, the *Thea Viridis* and the *Thea Bohea*, has been warmly advocated by many botanists, yet it is now, I believe, pretty generally admitted by all parties, that both green and black teas can be and are made, indiscriminately from the same parcel of leaves, taken from the same species of plant. It is also well known to all persons, that the infusions from these teas have marked differences of color and of flavor, and that the effects produced on some constitutions by green tea, such as nervous irritability, sleeplessness, &c., are very distinct from those of black tea. Their characteristic physical differences are too well known to require any comment, but they have peculiar chemical properties to which we shall have occasion to allude more particularly presently, and which have always been attributed by chemists to the effect of high heat in the process of manufacture.

The question presents itself then—from whence do these distinguishing peculiarities arise, and to what are they to be attributed? From observations made in other directions, in the course of the routine work of the establishment to which I am attached, I had formed in my own mind certain conclusions on this subject. I allude to the exsiccation of medicinal herbs; these are for the most part nitrogenous plants, as the *Atropa belladonna*, the *Hyoscyamus niger*, the *Conium maculatum*, and others. The plants are brought to us by the growers or collectors from

*Three years' wanderings in the Northern Provinces of China, by Robert Fortune.

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the country, tied up in bundles, and when they arrive fresh and cool they dry of a good *bright green* color; but on the contrary, it is found that if they are delayed in their transit, or remain in a confined state for too long a period, they become heated, from a species of spontaneous fermentation, and when loosened and spread open emit vapors, and are sensibly warm to the hand; when such plants are dried, the whole of the *green color* is found to have been destroyed, and a *red-brown* and sometimes a *blackish-brown result* is obtained. I had also noticed that a clear infusion of such leaves evaporated carefully to dryness was not *all* dissolved by *water*, but left a quantity of *brown oxidized extractive matter*, to which the denomination *Apothene* has been applied by some chemists; a similar result is obtained by the evaporation of an infusion of black tea. The same action takes place by the exposure of the infusions of many vegetable substances to the oxidising influence of the atmosphere; they become darkened on the surface, and this gradually spreads through the solution, and on evaporation the same *oxidised extractive matter* will remain insoluble in water. Again, I had found that the green teas, when wetted and redried, with exposure to the air, were nearly as dark in color as the ordinary black teas. From these observations, therefore, I was induced to believe that the peculiar characters and chemical differences which distinguish black tea from green, were to be attributed to a species of heating or fermentation, accompanied with oxidation by exposure to the air, and not to its being submitted to a higher temperature in the process of drying, as had been generally concluded. My opinion was partly confirmed by ascertaining from parties conversant with the Chinese manufacture, that the leaves for the black teas were always allowed to remain exposed to the air in mass, for some time before they were roasted. Mr. Ball, in his valuable work,* on the manufacture of tea, has described in detail the whole routine of these interesting processes, fully confirming my preconceived opinions, and of which I cannot do better than give you a summary. Some of the facts, I believe, had been published in Batavia in 1844, by Mr. Jacobson,† in the Dutch language. In the preface to his work, Mr. Ball says: "It will be seen by dates incidentally adverted to, that the facts and most of the materials of this work, were established and collected thirty years ago."—"These facts, as well as other materials, were derived from conversation with growers and manipulators from the tea districts; from written documents furnished by Chinese; from published works in the same language diligently sought out; and also from correspondence with a Spanish missionary long resident in the province of Fokim. These were all put into their present form full twenty years ago, and were read to one or two friends during my residence in China."—"They were not, however, so arranged, with any view to immediate publication."—"They were thus disposed as the best mode of recording and keeping together the facts and materials I had collected."—"But it was not till the year 1844, when I received Mr. Jacobson's Handbook on the cultivation of tea in Java, that I found my own views so far confirmed, and my information such as to justify me in bringing my labors to a close."

The processes peculiar to the preparation of black tea, are styled Leang-Ching, To-Ching, and Oc-Ching, and these all consist in carefully watched and regulated processes of *spontaneous heating* or *slow fermentation* of the leaves until a certain degree of fragrance is developed. The leaves are said to *wither and give*, and become soft and placid. The utmost care, practical skill, and experience is required in the properly conducting these operations, and as soon as the proper point is arrived at, the leaves are to be immediately removed, to the Kno or roasting-pan. After being roasted and rolled out two or three times, they are then to be dried, and this is effected in the Poey-long, which consists of a cylinder of basket-work, open at both ends, and covered on the outside with paper; it is about 2½ feet in height, and 1½ in diameter, which diameter is diminished in the centre like an ordinary dice-box to one foot and a quarter. This stands over and round a small charcoal fire, and is supplied with cross-bars about fourteen inches above the fire, on which an open sieve containing the tea is placed; and a small aperture about an inch and a half in diameter is made in the centre of the tea with the hand, so that an ascending current of air and the products of the combustion pass through and over the tea contained in the sieve. A circular, flat bamboo tray is placed partially over the mouth of this cylinder, and most probably serves to regulate the rapidity of the ascending cur-

* An account of the Cultivation and Manufacture of Tea in China, by Samuel Ball, Esq.

† Handboek v. d. Kult. en Fabrik v. Thee.

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rent, prevent the admission of the cold air to the leaves, and at the same time allow a sufficient outlet for the generated watery vapors and the products of combustion. At the commencement of this operation, the moist leaves are still green and retain their vegetable appearance; after the drying has continued about half an hour, the leaves are turned, and again submitted to the heat for another half-hour; they are then taken out, rubbed and twisted, and after sifting away the small dust, again returned to the sieve and drying tube. This operation of sifting is very necessary, to remove any of the small tea or dust which might otherwise fall through the meshes of the sieve on to the fire, and the products of their combustion would deteriorate and spoil the flavor of the tea. The leaves have now begun to assume their black color; the fire is diminished or deadened by ashes; and the operation of rolling, twisting, and sifting, is repeated once or twice until they have become quite black in color, well twisted, and perfectly dry and crisp. They are then picked, winnowed, and placked in large quantities over a very slow fire for about two hours, the cylinder being closed.

Now, that this black color is not owing to the fire is evident; for in cases mentioned by Mr. Ball, where the leaves have been dried in the sun, the same color is obtained; and on the other side, if roasted first, without the process of fermentation or *withering*, and then finished in the Poey-long, a kind of green tea is produced.

In the operations for the manufacture of green tea, on the contrary, the freshly-picked leaves are roasted in the Kuo at once, without delay, at a high temperature; rolled and roasted again and again, assisted sometimes with a fanning operation to drive off the moisture; and always with brisk agitation until the drying is completed.

The marked differences in the mode of manufacture of black and green tea, will, I consider, after what has been stated, fully account for all the variation of physical and chemical properties to which I have before alluded.

ADULTERATION AND SOPHISTICATION OF TEAS.

Since writing my former paper, several teas have come under my notice, which must be classed under this head. The first I shall mention is a sophistication which has been carried on in this country to some extent, and consists in giving the appearance of green tea to an imported black tea. The material used as the bodies for this process of manufacture is a tea called scented caper; it is a small, closely-rolled black tea, about the size of small *gunpowder*, and when colored, is vended under this latter denomination, the difference in price between the scented caper and this gunpowder being about 1s. per lb., a margin sufficient to induce the fraud. This manufacture has been carried on, I understand, at Manchester, and was kept as secret as possible; and it was only after considerable trouble that some of my friends succeeded in obtaining two different specimens for me, that could be fully depended on, as originating in this manufactory. It appears that it is generally mixed with other tea, so as to deceive the parties testing it. How this manufacture was conducted, I am not prepared to say; but some preparation of *copper* must have been employed, as the presence of that metal is readily detected in the specimens I received, I believe, however, that this sophistication has ceased.

I have now to call your attention to another adulteration of the most flagrant kind. Two samples of tea, a black and a green, were lately put into my hands by a merchant for examination, the results of which he has allowed me to make public. The black tea was styled *scented caper;* the green, *gunpowder;* and I understand they are usually imported into this country in small chests called catty packages. The appearance of these teas is remarkable; they are *apparently* exceedingly closely rolled, and very heavy; the reasons for which will be clearly demonstrated. They possess a very fragrant odor. The black tea is in compact granules, like shot of varying size, and presenting a fine glossy lustre of a *very black* hue. The green is also granular and compact, and presents a bright pale-bluish aspect, with a shade of green, and so highly glazed and faced, that the facing rises in clouds of dust when it is agitated or poured from one vessel to another; it even coats the vessels or paper on which it may be poured. On examining these samples, in the manner described in my former paper, to remove this facing, I was struck by the tenacity with which it adhered to the surface, and which I had never remarked in any previous sample, requiring to be soaked for some time in the water before it could be detached; with this precaution, however, the greater part of the facing material was removed. It proved, in the case of the sample of green tea, to be a pale Prussian blue, a yellow vegetable color, which we now know to be

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turmeric, and a very large portion of sulphate of lime. The facing from the sample of black tea was *perfectly black* in color, and on examination was found to consist of earthy graphite or black lead. It was observed, that during the prolonged soaking operation, to which these teas had been submitted, there was no tendency exhibited in either case to unroll or expand, for a reason which will be presently obvious. One of the samples was therefore treated with hot water, without however any portion of a leaf being rendered apparent. It increased in size slightly, was disintegrated, and then it was found that a large quantity of sand and dirt had subsided; this was separated by decantation, and collected; it was found to amount to 1·5 grains from 10 grains of the sample, or 15 in the 100 parts. It was evident, however, that much of the lighter particles must necessarily have been lost in the process of decantation; a weighed quantity of the sample was therefore carefully calcined, until the ash was quite white, and the whole of the carbonaceous matter burnt off, it yelded a result equivalent to 37·5 on the 100 parts. During this operation also, no expansion or curling of the leaf, as is generally to be observed when heat is applied to a genuine tea, was seen; in fact, it was quite evident that there was *no leaf to uncurl*, the whole of the *tea* being in the form of dust. The question next presented itself as to how these materials had been held together, and this was readily solved; for, on examining the infusion resulting from the original soaking of the sample, abundant evidence of gum was exhibited.

The sample of green tea was of a precisely similar kind to the black; it yielded 4·55 grains of ash, &c., from 10 grains of the specimen, or 45·5 per cent. A specimen of Java gunpowder yielded 5 per cent. of ash; so that we have in this sample 40·5 per cent. of dirt and sand over and above the weight of ash yielded by the incineration of a genuine tea.

Thus we have then in these samples a mixture of tea-dust with dirt and sand, agglutinated into a mass with a gummy matter, most probably manufactured from rice-flour, then formed into granules of the desired size, and lastly dried and colored, according to the kind required by the manufacturer, either with black lead, if for black tea; or with Prussian blue, gypsum, or turmeric, if intended for green.

Since examining these two samples, I have obtained through a friend another specimen of green tea, having a very different appearance; that is, better manufactured, or rather, I should say, more likely to deceive the consumer, from its being made to imitate an *unglazed tea*. It is of a yellowish-green color, scented and granulated as the former samples, and not much dusted; it yielded 34 per cent. of ash, sand and dirt.

On inquiry, I have learnt that about 750,000 lbs. weight of these teas have been imported into this country within the last eighteen months, their introduction being quite of modern origin; and I understand that attempts have been made to get them passed through the Customs as *manufactured goods*, and not as teas; a title which they certainly richly merit, although it must be evident, from a moment's consideration, that the revenue would doubtless be defrauded, inasmuch as the consumer would have to buy them as teas from the dealer. It is to be feared, however, that a market for them is found elsewhere. The Chinese, it appears, will not sell them except as teas, and have the candor to specify them as *lie* teas; and if they are mixed with other teas of low quality, the Chinese merchant gives a certificate, stating the proportion of the *lie tea* present with the genuine leaf. This manufacture and mixing is evidently practised to meet the price of the English merchant. In the case of the above samples, the black is called by the Chinese, *lie flower caper*; the green, *lie gunpowder*; the average value is from 8*d*. to 1*s*. per lb. The brokers have adopted the curious term *gum and dust*, as applied to these lie teas or their mixtures, a cognomen which at first I had some difficulty in understanding, from the rapid manner in which the two first words were run together.

I may subjoin the results obtained from the careful incineration of a variety of teas, as they may be interesting, for the purpose of comparison, and illustrate the point I have mentioned as to these spurious teas being mixed with genuine ones.

Gunpowder tea, made in Java, gave 5·0 grains of ash in the 100 parts;	
Gunpowder, during the East India Company's Charter	5·0
Kemaon hyson	6·5
Assam hyson	6·0
Lie gunpowder, No. 1	45·5
,, No. 2	34·0
Scented caper	5·5
Lie flower caper	37·5
Mixtures containing these lie teas	
No. 1	22·5
No. 2	11·0

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ON AGRICULTURAL CHEMISTRY, ESPECIALLY IN RELATION TO THE MINERAL THEORY OF BARON LIEBIG.*

BY MR. J. B. LAWES AND DR. J. H. GILBERT.

Mr. PUSEY had, in a recent article in the *Agricultural Journal*, on the progress of agriculture during the last eight years, quoted the experiments of Mr. Lawes and Dr. Gilbert, as being conclusive as against the "Mineral Theory" of Baron Liebig, which asserts that the crops on the farm rise and fall according to the supply within the soil of the mineral constituents indicated by an analysis of the ashes of the plant. To these observations of Mr. Pusey, Baron Liebig has replied at some length, in the new edition of his 'Letters on Chemistry,' just published, and in doing so, has asserted that the experiments alluded to are without value, and that the statements of the authors could only be made in ignorance of the rationale of agricultural practices on the large scale. The authors have therefore given in the present paper an outline of their investigations in Agricultural Chemistry; comprising an extensive series of experiments in the field on the growth of the principal crops entering into a rotation, as well as on the chemistry of the feeding of animals, and that of the functional actions of plants generally, in relation to the soil and atmosphere; in connexion with all of which branches much laboratory labor has constantly been in progress since the commencement of the experiments themselves in 1843. The results selected by Mr. Lawes and Dr. Gilbert, in justification and illustration of their views, were those of the field experiments on wheat, grown continuously on a previously exhausted soil for the last eight years, and in each season, by means of many chemical manures by the side always of one or more plots unmanured, and one manured continuously by farm-yard manure. Some of the results thus obtained were illustrated by a diagram, from which it appeared that mineral manures had scarcely increased the produce at all when used alone, whilst the effects of ammoniacal salts were very marked, even when repeated year after year on the same space of ground from which the entire crop—corn and straw—had been removed. Indeed, in this way, a produce had been attained even in the sixth and seventh succeeding years of the experiment, exceeding by nearly two-thirds that from the unmanured plot. It was then shown, that the mineral constituents of the soil continued to be in excess, relatively to the nitrogen available for them from natural sources. The history of several plots was then traced down to the last harvest (1850,) and it was argued that the statements assailed by Liebig, viz., that ammonia was specially adapted as a manure for wheat, was fully borne out when speaking of agriculture as generally practised in Great Britain. In other words that in practice it was the defect of nitrogen rather than of the mineral constituents that fixed the limit to our produce of corn. The authors next called attention to the fact of the exhalation of nitrogen by growing plants, as proved by the experiments of De Saussure, Daubeny and Draper, and they referred to some experiments of their own, with the view of showing the probability that there is more of the nitrogen derived from manure given off during the growth of cereal grains than by leguminous and other crops; and hence might be explained the great demand upon nitrogenous manures observed in the growth of grain. The authors suggested that here was an important field of study, and that we have in the facts alluded to much that should lead us to suppose that the success of a rotation of crops depends on the degree in which the restoration of the balance of the organic constituents of crops was attained by its means, rather than on that of their mineral constituents, according to the theory of Liebig; whilst the means adopted to secure the former were always attended with a sufficient supply of the latter. Again, Professor Liebig has quoted the processes of fallowing and liming, as being in their known results inconsistent with the views of Mr. Lawes and Dr. Gilbert; but these gentlemen considered that the experiments of Mulder and of Way on the properties of soils justified them in supposing that the processes of fallowing and liming owed their efficacy more to the accumulation of nitrogen in the soil from natural sources than to that of available mineral constituents: the latter did, however, undoubtedly thus accumulate by those processes, and this fact should give us more confidence in views which, on independent evidence, supposed that they were not so easily liable to be found in defect in relation to other necessary supplies. It was next shown, by reference to what happens in actual practice as generally followed in Great Britain, where corn and meat constitute almost the exclusive ex-

* *British Association.*

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ports of the farm, that the mineral constituents of the crops, taken collectively,—that is, as shown by the analysis of their ashes, could not be considered as exhausted: of these, however, phosphoric acid was lost to the farm in much larger proportion than the alkalies; whilst the latter would generally, by the combined agencies of disintegration of the native soil, and import in cattle food, be liable to diminution in but a very insignificant degree, if not in some cases to accumulation. Practical agriculture had, indeed, decided that phosphoric acid must be returned to the land from sources external to the farm itself,—viz., by bones, guano, or other means. But, on the other hand, artificial alkaline manures had generally been found to fail in effect. Indeed, taking into careful consideration the tendency of all experience in practical agriculture, as well as the collective results of a most laborious experimental investigation of the subject, both in the field and in the laboratory, it was the authors' deliberate opinion that the analysis of the crop is no direct guide whatever as to the nature of the manure required to be provided in the ordinary course of agriculture, from sources extraneous to the home manures of the farm,—that is to say, by artificial manures. Reviewing, then, the actual facts of practical agriculture, the authors could not agree with Baron Liebig when he asserted that our grand object should be to attain an artificial mixture to substitute for farm-yard manure, which he admitted to be the universal food of plants. The very practice of agriculture itself, as followed in this country, necessitates the production of farm-yard manure, and all our calculations should be made on the supposition of its use.

EXTRACT OF A MEMOIR ON A RELATION EXISTING BETWEEN THE COLOR OF CERTAIN COLORED FLAMES WITH THE HELIOGRAPHIC IMAGES COLORED BY LIGHT.*

BY M. NIEPCE DE SAINT VICTOR.

I deposited at the Academy of Sciences, on the 24th of March last, a very detailed memoir on this subject, of which I now give as succinct an analysis as possible.

It is known that a plate of silver immersed in a solution of sulphate of copper and chloride of sodium, at the same time rendered electro-magnetic by means of a battery, is chloridised and becomes susceptible of receiving color, when on being withdrawn from the solution, it is exposed to the action of the light.

It is also well known that M. Edmond Becquerel, by exposing this plate to the colored rays of the solar spectrum, obtained an image of this spectrum in such a manner that the red ray produced on the plate an image of a red color, the violet ray a violet color, and the same with the other rays. My observations having led me to think that it was possible there might be some relation between the color which a body communicates to a flame, and the color which light develops on a plate of silver which had been chloridised with the body which colors that flame, I undertook the series of expriments which I now submit to the Academy.

The bath in which I immersed the plate of silver, was formed of water, saturated with chlorine, to which I added a chloride endowed with the property of coloring flame with the color which I wished to reproduce on the plate.

For example, it is well known that chloride of strontium gives a purple color to flames in general, and in particular to that of alcohol. If a plate of silver be prepared by passing it through water, saturated with chlorine, to which chloride of strontium has been added, and if, afterwards, the back of a drawing containing red and other colors be applied against the plate, and the whole exposed to the light of the sun for ten or fifteen minutes, it will be found that the colors of the picture are reproduced on the plate, but that the red is much more distinct than the other colors.

When we wish to reproduce successively the other six rays of the solar spectrum, the same method must be employed as that followed in the case of the red ray, by employing the chlorides of calcium or uranium for orange, hypochlorite of soda, or the chlorides of sodium or potassium, as also pure solution of chlorine for yellow; for if we steep a plate of pure silver in a solution of chlorine for some time, and if we afterwards expose it to the flame of a spirit-lamp, a beautiful yellow flame is produced.

When a silver plate is immersed in a solution of chlorine, or when the plate is exposed to its vapor (but in the latter case the bottom of the plate always remains dull, although the colors are reproduced) all the colors are obtained by the light, but the yellow is the only one that is at all vivid.

* *Comptes Rendus*, June 2nd, 1851.

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I have obtained very beautiful yellows, with a bath composed of water slightly acidulated with hydrochloric acid, and a salt of copper. The green ray was obtained by means of boracic acid, and chloride of nickel, as well as all the salts of copper. The blue ray is obtained by the employment of the double chloride of copper and ammonia.

The indigo ray is obtained with the use of the same substance. The violet ray, with chloride of strontium, and sulphate of copper.

Lastly, if alcohol, acidulated by hydrochloric acid be inflamed, a yellow, blue, and greenish flame is obtained, and if the plate of silver be prepared with water, acidulated with hydrochloric acid, all the colors are obtained by the action of the light; but the ground of the plate is always black, and this preparation of the plate can be made only by means of the battery.

These are all the substances producing colored flames, which also furnish colored images by means of light.

I find that substances which do not produce colored flames, do not give colored images by the light; that is to say, only a negative image is produced on the plate, composed only of black and white, as in ordinary photography.

Some substances give white flames, such as chloride of antimony, chlorate of lead, and chloride of zinc. The first two give a bluish white flame, and the last a white flame with a greenish or bluish tint. These three chlorides give no color with light if employed alone; but if they are mixed with other substances which produce colors, we obtain, in addition, white grounds, a very difficult thing, because, from the fact that there does not exist either black or white property, so called in these phenomena of colorations; and if I have been able to obtain them, it is only by means of the chloride of zinc or chlorate of lead which I added to my baths, but in very small quantity, because they prevent the reproduction of colors.

I have reproduced all the colors of the model by preparing the plate with a bath composed of deutochloride of copper. This result is easily explained, it appears to me, by the observation that a flame of alcohol or wood, to which chloride of copper has been added, presents not only green, but also successively all the other colors of the spectrum, according to the intensity of the fire; it is the same with almost all the salts of copper mixed with chlorine.

I will now refer to the supplement of my memoir which will be found entire at the conclusion of this extract, and in which I have placed in categories all the substances which, in the state of chlorides or chlorates, have an action in these phenomena of coloration. The substances which do not give colored flames do not give colored images with light.

I give, in my memoir, the composition of the baths with which the silver plate is prepared; but as they are numerous, and as moreover I have not noticed all the combinations I have made, I have selected two or three of them which have appeared to me preferable, especially for preparing the plate without making use of the battery.

I have already stated that liquid chlorine impressed the silver plate by a simple immersion and gave all the colors, but they are feeble, with the exception of the yellow; this is because the layer is too thin, and it can be made thick only by means of the battery.

If we put a salt of copper into liquid chlorine, a very thick layer will be obtained by simple immersion, but the mixture of copper and liquid chlorine is always badly made. I prefer taking deuto-chloride of copper, to which I add three-fourths of its weight of water. This bath gives very good results; however, I prefer a mixture of equal parts of chloride of copper and chloride of iron with three-fourths of water, The chloride of iron has, like that of copper, the property of impressing the silver plate and of producing several colors, but they are infinitely weaker, and the yellow always predominates. This accords with the yellow color of the flame produced by the chloride of iron.

If a bath be formed composed of all the substances, which, taken separately, give a dominant color, very vivid colors will be obtained; but the great difficulty is to mix them in suitable proportions, as it almost always happens, that some colors are excluded by others.

I must not omit to mention, that there exists great difficulty in obtaining the colors, still more so than in all other photographic processes; for although the plates may be prepared in the same manner, the same results are not always obtained; this arises, amongst other causes, from the thickness of the coating of chlorine and its degree of concentration, which varies according to the chlorides employed.

ON THE INFLUENCE OF WATER AND OF HEAT IN THESE PHENOMENA OF COLORING BY LIGHT.

The influence of water is indubitable,

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as dry chlorine produces no effect; whilst by the employment of chlorine rendered liquid by immersion, or by aqueous vapor, the reproduction of all the colors which I have named, are obtained.

With regard to heat, I have noticed that when the plate, which has been submitted to the action of chlorine, is heated from underneath by the flame of a spirit-lamp, it takes successively all the colors produced by heat. Thus the plate, which, when taken from the bath, is of a dull color, takes successively by means of heat, the following colors, viz., reddish brown, cherry red, bright red, up to a white tint; in this latter state, it produces no effect when exposed to the light; the exposure should take place at a cherry red heat.

GENERAL OBSERVATIONS ON THESE PHENOMENA.

It is a remarkable circumstance, that in order to obtain these coloring effects, it is absolutely necessary to operate on metallic silver, prepared as I have mentioned; for the nitrate, the chlorine, the cyanide, and the sulphate of silver, spread on paper or starch coating, give only black and white. It may, perhaps, be that by employing silver in powder mixed with the substances which I have named, some result may be obtained by coating a sheet of paper with the mixture; this is an experiment which I intend to make. I have already tried silvered paper with good results, but not so satisfactory as those furnished by the metallic plate.

We have seen that all the substances which give colored flames, give also colored images, and almost always in relation with their respective colors; for if I have not been able to isolate completely a ray, that is to say, to obtain but one single color on the plate, to the exclusion of all others, I have always obtained a dominant color according to the substance which I have employed; and if we cannot obtain a single color, it is because the chlorine, which is the indispensable substance for obtaining them, produces them all by itself, as we have seen in operating with pure liquid chlorine; but, in this case, the colors are always very feeble, whilst they separately assume much vivacity according to the substances which has been employed in mixture with the liquid chlorine.

Neither iodine nor bromine can be employed like chlorine for this purpose. Neither of them produce colors or colored flames: even when theyare combined with copper, they give only a green flame. Chlorine, in the state of chloride or chlorate, is the only substance which gives to metallic silver the property of being colored by light.

I have also observed that certain colors took a longer time to appear, and that during this time, others had disappeared.

MODE OF OPERATING.

All my baths or solutions were formed in the proportion of one-fourth by weight of chloride, and three-fourths of water: these are the proportions which I have found to be most suitable.

When hydrochloric acid with a salt of copper is employed, it must be diluted with one-tenth its weight of water. The liquid chlorine must not be in too concentrated a state if fine yellow colors are required.

In baths composed of several substances, it is essential to filter or to decant off the liquor, in order to obtain it very clear; it is then kept in a jar ready for use as occasion may require.

More of this solution must not be taken than will be necessary to prepare two plates, at the most, because the bath becomes considerably weakened at each operation; it may, however, be revived by the addition of a few drops of hydrochloric acid.

When operating on silver of a standard of 1,000th (pure silver), I have obtained colors more lively than on a plate which contained one-tenth part of copper. I then operated on a silver plate of the standard $\frac{745}{1000}$, when I obtained only very dull colors; hence it is preferable that the silver should always be of the purest quality for these experiments.

The plate being completely polished, (for which purpose tripoli and ammonia must be employed), it is immersed in the bath at one stroke, and allowed to remain there for some minutes, in order to receive a coating of sufficient thickness. On removing the plate from the bath, it must be rinced in a large quantity of water, and then dried over a spirit-lamp. In the bath it assumes a dull, almost black color, and if thus exposed to the light, the colors are equally produced, but much more slowly, and the ground will be always black; in order, therefore, to obtain a clear ground, and that the operation may be more rapid, the plate must be brought by heat to a cherry color, and it is at this point, as I before said, that it should be exposed to the light.

The length of exposure varies very much, according to the preparation of

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the plate; but it may be calculated that two or three hours will be required to obtain a proof in the camera. This is certainly a long time; but the question of accelerating the operation being but a secondary one, I have not as yet turned my attention to it. I may, however, mention that fluoride of sodium, as well also as chloric acid, and all the chlorates, much accelerate the operation.

ON FIXING THE PROOFS.

Hitherto, I have not been able to fix the colors; they disappear very quickly, even in diffused light; there is no preserving them. I have made more than a hundred attempts, but without obtaining the least satisfactory result. I have tried all the acids, and all the alkalies; the former freshen up the colors, and the latter take them out, destroying the chlorine, and leaving only a dark image. It is by this means that I have obtained proofs identical with the daguerreotype image, and sometimes without any of that mirror-like appearance common to them: it is sufficient, in order to obtain the last to have a very thick layer on the plate, and not to leave them exposed to the light so long.

The problem of fixing colors still appears to be very difficult of solution; nevertheless, I still continue my researches, and have already succeeded in a momentary fixation of them, by exposure of the colors to the flame of a spirit-lamp containing chloride of sodium or hydrochlorate of ammonia.

I have ascertained that these phenomena of coloring are exhibited as well in *vacuo* as on exposure to the air; consequently, oxygen performs no part in the operation. The three agents are, water, heat, and light, which is the principal.

I have studied the property of each chloride, both separately, and simultaneously with liquid chlorine, or with a salt of copper; for if the plate be not prepared by means of the battery, a salt of copper is indispensable for obtaining a layer of a certain thickness; and, in this case, the colors are less vivid.

SUPPLEMENT TO THE MEMOIR PRESENTED TO THE ACADEMY ON THE 24TH MARCH, 1851.

I have proved that these phenomena of coloration by light are manifested in *vacuo*, as well as in the air; consequently, oxygen performs no part. There remain, therefore, three agents—water, heat and light—the last being the principal one.

I have studied the property of each chloride, either separately, or simultaneously with liquid chlorine or with a salt of copper, for if the silver plate is not prepared by means of the battery, a salt of copper is indispensable for obtaining a layer of a certain thickness, and, in this case, the colors are much more vivid.

I now give the nomenclature of all the chlorides, which I have employed, arranged categorically:—

ACTION AND PROPERTIES OF EACH CHLORIDE.

First Category.—Chlorides which, being employed alone, act on the silver plate in such a manner as to make it take all or many of the colors of the model. These are the chlorides of copper, iron, nickel, and potassium, and the hypochlorites of soda and lime, as well as liquid chlorine by immersion or in vapor.

Second Category.—Chloride which, employed alone, act on the silver plate, but which do not give colored images with light. These are the chlorides of arsenic, antimony, bromine, bismuth, iodine, gold, platinum and sulphur.

Third Category.—Chlorides which, employed alone, do not act on the silver plate, but which act on it when mixed with a salt of copper (especially with sulphate or nitrate of copper) and which then give chlorides with the aid of light. These are the chlorides of aluminum, silver, barium, cadmium, calcium, cobalt, tin, manganese, magnesium, phosphorus, sodium, strontium and zinc. Hydrochloric acid diluted with one-tenth of its weight of water, and mixed with nitrate of copper acts on the plate, and gives all the colors.

Fourth Category.—Chlorides or chlorates which, although mixed with a salt of copper, and acting on the plate of silver, do not give colors by light. These are chloride of mercury and chlorate of lead.

To sum up, the first category contains the chlorides which, being employed alone, act on the silver plate in such a way as to make it take all or many colors; and, which is a remarkable thing, all these chlorides likewise give, by combustion, colored flames.

The second category contains chlorides which act on the plate when employed alone; but as none of them give colored flames, so they do not give colored images by light, even when mixed with a salt of copper.

The third category contains the chlorides which alone do not act on the silver plate, and which do not give colored flames, (with the exception of those of barium and

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zinc, which give feeble colors); but by mixing them with a salt of copper, chloride of copper is formed; then they become, in this case, capable of acting on the plate, and of producing colors by light.

The fourth category contains the chlorides which although mixed with a salt of copper, and, in this case acting on the silver plate, do not produce color with light; they do not either give colored flames when burned alone, and combined with a salt of copper they give only a green flame.

There exist also a great number of chlorides on which I have not experimented, because they are too high in price to be employed, especially for forming baths.

These chlorides are those of carbon cerium, chromium, cyanogen, iridium, molybdenum, palladium, silicium, rhodium, titanium, tungsten, and zirconium.

CONCLUSION.

During the year that I have been occupied with these experiments, I have observed many facts. I have repeated the experiments a great number of times, and it was only after doing so that I wrote the memoir which I have had the honor of presenting to the Academy.

Now, according to the facts which I have observed, it appears that, if there is not a complete similarity between the colored flames and the colored images obtained by light on a plate of silver prepared with the chlorides or chlorates which color flames, there is a great analogy between these colors.

ON A NEW METHOD OF CONTRACTING THE FIBRES OF CALICO, AND OF OBTAINING ON THE CALICO THUS PREPARED COLORS OF MUCH BRILLIANCY.

BY MR. MERCER.

COMMUNICATED BY DR. PLAYFAIR.

Mr. MERCER had his attention drawn to the subject by experiments made as early as 1844. Dr. Playfair briefly called attention to the states of water, the points of maximum density so well known, and the experiments of Mr. Mercer, who found that above this point water flowed more rapidly through a syphon than at the same number of degrees below this point of maximum density. He then spoke of the theoretical views of those chemists who look upon the combined water as in the state of ice, or free from fluidity.

Mr. Mercer's discovery may be stated in few words to be this:—a solution of cold but caustic soda acts peculiarly upon cotton-fibre immediately causing it to contract,—and although the soda can be readily washed out, yet the fibre has undergone a change, and water will take its place and unite with the fibre. In a practical point of view Mr. Mercer considered that the fibre might be considered by this action to have a sort of acid property to unite with soda and then with other bases. The effect of the condensation was said to be one-fifth to one-third of the total volume of cotton employed.

Dr. Playfair then showed some proofs of the influence of this new process upon our cotton manufactures; thus, taking a coarse cotton fabric and acting upon it by the proper solution of caustic soda, this could be made much finer in appearance; and if the finest calico made in England, known as 180 picks to the web, was thus acted upon, it immediately appeared as fine as 260 picks. Stockings of open weaving were shown, and the condensation process made them appear as of much finer texture. The effect of this alteration of texture was most strikingly shown by colors. The pink cotton velvet had its tint deepened to an intense degree by the condensation process. Printed calico, especially with colors hitherto applied with little satisfaction, as lilac, had strength and brilliancy, besides thus producing fabrics cheaply finer than can possibly be woven by hand.

The effect was shown of patterns being formed by portions of a surface being protected by gum from condensation. Thus patterns of apparently fine work can easily be produced.

It was stated that the fabrics by this process have much strength given them; for a string of calico one-half condensed by caustic soda will break by 20 oz., while the unacted-upon string of cotton broke with 13 oz.

A discussion ensued, in which Dr. Faraday, Mr. Warrington, Professor Dumas and others took part; and it was proposed that the microscope should be employed to ascertain any other obvious change of properties by this new process, that bids fair to exercise an immediate and extensive alteration in the patterns and produce of cotton fabrics.

Dr. Playfair, in reply, said, that caustic soda had long been used for bleaching, but this power of altering the texture only belongs to the cold solution of cautic soda. These specimens were the only complete

* *British Association*; from *The Athenæum*.

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ones, and he had been permitted to bring them from the Great Exhibition to exhibit before the Association.

COMPOSITION FOR TAKING CASTS OF MODELS.

To the Editors of The Chemist.

GENTLEMEN—In the course of experiments in which I, in common with many other of your subscribers, have been engaged, (viz., the electrotyping art), I have had many opportunities of testing the comparative value of the several compositions generally used for taking casts of models, and I have hit upon one which is, I think, superior to any, even to the one proposed by one of your correspondents in No. 22, p. 308.

This useful composition is merely a mixture of 8 parts white wax, 2 parts spermaceti, and 1 part, or less, flake-white.

I have tried a composition of black-lead and wax, but cannot make it answer, perhaps through my carelessness.

Hoping that the above may prove useful to some of your readers,

I am, Gentlemen, yours respectfully,
Brompton. A. C. W.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in figuring and ornamenting woven fabrics and in machinery employed therein. PETER WOOD, of the firm of Thomas Bury & Co., dyers, calenderers, and finishers, Adelphi Works, Salford. Patent dated December 11th, 1850.

The method usually adopted in figuring and ornamenting woven fabrics with metal is to attach the pattern to the fabrics by means of glair or other adhesive matter, either in the state of leaf or finely granulated powder. The patentee combines the metal in a finely divided or precipitate state with starch or other similar substance, so as to produce a pasty mixture, with which the design is printed in the same manner as in ordinary color printing; or when both sides of the fabric are required to be ornamented it is passed through a trough of the mixture, and the excess removed by brushes, after which it is dried by steam-heated cylinders. A suitable paste for this purpose is prepared by boiling 6 lbs. of starch and 3 oz. of bees-wax in 6 gallons of water, adding thereto 28 lbs. of metal, and stirring the whole till well incorporated. In order to produce a glossy appearance, and bring out the full brilliancy of the metal, the printed fabric is passed between calender rollers (but where this process would be attended with injury to the unornamented portions of the cloth other means of pressure must be adopted), and, when necessary, gloss can be removed from the non-metallized portions of the fabric by any of the methods usually adopted for this purpose.

Claims.—1. The figuring and ornamenting of woven fabrics by the use of a mixture of finely divided or pricipitate metal made into a paste with starch or other similar substance.

2. An arrangement of apparatus applicable for the purpose of ornamenting fabrics with such paste.

Improvements in the manufacture of sugar. JOHN MATHISON FRASER, of Mark-lane, merchant. (A communication. Patent dated December 27, 1850.

This invention consists in a method of treating the expressed cane or beetroot juice by adding quicklime, and subsequently a saturated aqueous solution of sulphurous acid in certain specified proportions. The acid for this purpose may be procured by the direct combustion of sulphur in atmospheric air, or by heating metallic oxides (such as that of manganese) and sulpher, or by decomposing sulphuric acid by the aid of heat, and of certain metals (such as mercury or copper), or carbonaceous materials (such as wood charcoal.) The last is the process preferred by the patentee, and in carrying it into effect he employs an apparatus consisting of three closed vessels communicating with each other by pipes, the first to contain the wood charcoal operated on (which is coarsly powdered and imbued with eight times its volume of sulphuric acid); the second, water to wash the acids evolved, and the third, the water to be saturated. The application of heat to the first vessel in the range causes the evolution of sulphurous and carbonic acid gases, which pass through the water in the second vessel into the third, the water in which is saturated with the sulphurous acid, whilst the carbonic acid gas is allowed to escape, together with the superabundance of the sulphurous acid. This loss may, however, be prevented by employing a larger number of receivers. The "Sulphurous solution" thus obtained should be bottled off into carboys and corked up for use. Its specific gravity should be about 1·05, and it should contain thirty volumes of gas to one of water.

* Collected from *The Mechanic's Mag.*

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The method in which quicklime and the solution are employed is as follows :—The expressed cane-juice is poured into an open vessel through a sieve containing 0·312 lbs. Netherlands, of quicklime and a similar quantity of lime is mixed with four cans Netherlands (about seven eights of a gallon(of juice, to about the consistence of cream, and held ready for use. This quantity is sufficient for 1000 cans, or about 220 gallons English measure. When about 500 cans of juice have run into the vessel, the above-named mixture is added, together with three cans of solution and the whole well incorporated by stirring. After this the remainder of the juice is run in, another can of solution added, and the mixture stirred and allowed to settle. The clear liquor is drawn off when subsidence of the suspended particles has taken place and is boiled in an open pan, the scum and flakes which rise during the operation being carefully and completely removed. The liquor will at first have an olive-brown color and a peculiar odor and will throw up brown flakes; but as the boiling proceeds the smell lessens, and the color gradually changes to a green, and finally assumes a rich golden hue, throwing up at this time yellow-colored flakes. When the colour is quite clear the boiling is discontinued, and the liquor is then fit for evaporation and crystallization in the ordinary manner. The boiling may be conducted in the vacuum pan, care being taken to remove the scum in this as in the former operation. This may be conveniently done about the time when the density of the liquor is about 38° Beaumé, equal to a specific gravity of 1·3.

The patentee does not claim generally the employment of quicklime and sulphurous acid in the purification of saccharine juices, but he claims the treatment of such juices in the manner and for the purposes set forth.

For certain chemical compositions for rendering cotton, linen, woollen, silk, and other fabrics impervious to water, "and fixing colors in dyeing." CELESTE MENOTTI, of Rue de la Paix, Paris. Patent dated December 27, 1850.

The words of the title contained between inverted commas have been disclaimed. The method adopted by the patentee in manufacturing his improved waterproofing composition, which he calls "hydrofugine," is as follows:—1. In a vessel capable of holding three gallons he places 22 lbs. of sulphate of alumina or of potassa and alumina, or of alumina and ammonia, or sulphate of zinc or copper, or chloride of tin, reduced to powder (with the exception of the sulphate of alumina which is cut in slices, and the chloride of tin which is employed in a crystallized state.) 2. In a second similar vessel he places 14 oz. of oleic, stearic, or margaric acids (the two last of which substances are known in commerce as stearine), or of some soap or saponaceous matter. 3. He mixes the oleic acid, or dissolves the other substances by the aid of heat, in two gallons of alcohol at 30° Cartier, and pours this compound on the salt employed: then submits the whole to a temperature of about 30°Reaumur, and obtains the hydrofugine in a dry, powdered or moulded state. For waterproofing cotton and linen cloth, one part of the composition is dissolved in 100 parts of water, and the fabric after having been soaked in the solution is hung up to dry, and is then in a finished state. For silk and woolen, one part of the composition is added to 200 parts of water. Paste board, cards, and other material, may be also treated with this composition, which possesses the advantage of permitting the passage of air, whilst it effectually excludes wet and moisture.

Claim.—The processes described for the production of the composition called by the inventor hydrofugine, and its application for rendering linen, cotton, silk, woollen, and other fabrics impervious to water, but pervious to air.

Improvements in the manufacture of wafers. JOHN HARCOURT BROWN, of Fir Cottage, Putney, Gentleman. Patent dated January 7, 1851.

Mr. Brown's improved wafers are composed of very thin sheets of metal or metallic alloys of any description, and either plain or ornamented by gilding, varnishing, or lackering, coated with an adhesive compound. The compound which the patentee employs, consists of sixteen parts strong glue, four parts clean gum arabic, five parts treacle or other saccharine substance, three parts spirits of wine, one part camphor, one part virgin wax, and twelve parts distilled water. These ingredients are heated in a closed vessel by means of a sand bath, and maintained for about eight hours at a temperature of 210°Fahr.; then filtered and diluted to the fluidity of water (in which alum has been dissolved, in the proportion of one part to every fifteen parts water), being kept during the time, just below boiling point. The sheets of metal to be coated are passed between a pair of metal rollers, one having a plain polished, and the other a slightly-roughened surface, and after the composition has been applied to the roughened side of the sheets, and allowed to dry, they are

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cut or punched into wafers of any form or pattern.

Claims.—1. The composition for rendering metals or metallic alloys adhesive for the purpose of securing letters and envelopes, wherby they are rendered impervious to damp and unaffected by wet, which is not the case with sealing-wax, wafers, and adhesive compounds at present in use.

2. The employment of machinery for roughing the surface of the sheets of metal and any other compound, in addition to that above described, for rendering them adhesive.

Improvements in the preparation of peat and other ligneous and carbonaceous substances, and the conversion of some of the products derived thereby; and also in the mode of application of some such products to the preservation of substances liable to decomposition and destructive agencies, and which mode is also applicable to other products of a similar nature. WILLIAM HENRY GREEN, of Basinghall Street, gentleman. Patent dated December 19, 1850.

Claims—1. An improved method of preparing peat for conversion into fuel in so far as regards the mode of introducing the peat into the heating chamber, combined with means of regulating and diffusing the heat.

2. Another method of operation, in so far as regards the consecutive movement of the carriages or wagons carrying the peat through the drying-chamber from the outer end towards the furnace end of the drying-chamber, combined with the application of hot air for the purpose of desiccating the peat.

3. The adaptation of a "rotary separating machine," in which the peat is to be operated upon for expelling the moisture by the joint operations of centrifugal action, hot air, surcharged steam, or heated gases.

4. A method of compressing peat for the purpose of conversion into fuel by means of rollers, whether used by themselves or in combination with a hot plate.

5. An improved apparatus for carbonising peat, in so far as regards the paraboloinal form given to the stoves, and an additional pipe for the purpose of carrying off the gases.

6. Another method or apparatus, in so far as regards the position of the supply hopper, and the continuous discharging chain and the receiving or cooling chamber.

8. The consolidation or solidification of peat, by subjecting the same in the processes of pulverisation, and while in a heated state, to a concussive pressure.

9. A peculiar construction of apparatus for carbonising or otherwise preparing other ligneous and carbonaceous substances.

10. A composition for preserving woods and other substances, formed by the combination of the tarry product of carbonised peat with sulphate of iron and rosin.

11. A method of supplying the said composition and others of a similar nature to the preservation of woods.

Improvements in coating or covering metals EDMUND MOREWOOD and GEORGE ROGERS, of Enfield, gentlemen. Patent dated December 12, 1850.

In coating zinc with lead by casting, a quantity of lead is first melted in a shallow vessel, and when it has been raised above the melting point of zinc, pieces of that metal are placed on the surface of the lead, or molten zinc is poured on; and after standing some time to allow the metals to separate, in the event of their having become mixed, the vessel is removed, and the slab cooled down altogether, or to about 300° Fahr., when it may be rolled in the customary manner. In order to coat the zinc on the opposite side, when both sides are required to be so coated, the slab is heated to a little above the melting point of lead and sprinkled with sal-ammoniac, and a stick of lead rubbed on until a sufficiently thick coating is obtained. In coating zinc with copper a slab of copper is prepared by melting in a shallow vessel and allowed to cool down to a little above the melting point of zinc, or a plate of copper is heated to the requisite temperature and sprinkled with sal-ammoniac, or other suitable flux, and the coating is effected in either case by rubbing the surface of the copper with a stick of zinc, till a sufficient quantity has been deposited on it; or two slabs of copper are placed in a mould, and molten metal poured in between them. To coat zinc with tin or solder, the zinc is sprinkled with sal-ammoniac, and heated, and a stick of solder rubbed on until a sufficient quantity is melted to obtain the requisite depth of coating. Lead may be coated in a similar manner, and these prepared sheets may be attached to sheet tinned or zinced iron, by sprinkling the surfaces to be united with weak muriatic acid or sal-ammoniac, and laying the tinned lead or zinc on the tinned surface of the plate of iron, which is to be previously heated to above the melting point of the tin or solder. A heated roller is then passed over the two surfaces, to maintain them in contact and prevent buckling or warping, after which a colder surface is ap-

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plied, to aid in causing the solder to set rapidly.

Another improvement is the employment of a reverberatory furnace in coating with lead, &c., the surface of the metal to be melted being covered with coal, charcoal, or other similar substance, to facilitate the operation.

No claims.

Improvements in the manufacture of steel. HENRY MORTLOCK OMMANNEY, of Chester, esquire. Patent dated December 19, 1850.

The peculiarity of this method of manufacture consists in employing iron ores, being oxides of iron, and other oxides thereof previously deoxidised by exposure to different degrees of heat, in an open furnace so constructed that the ore or oxide and carbon may be introduced at a part of the furnace where the temperature is comparatively low, and may be successively removed to hotter parts, being subjected the while to continual stirring; for which purpose, and for the introduction and removal of the matter operated on, each compartment of the furnace is provided with suitable doors or openings.

The patentee has shown and described an arrangement of reverberatory furnace adapted for the purpose of his invention. It consists of three compartments communicating with each other, heated one end in the ordinary manner, and provided with a hopper at the other end to facilitate the supply of the ores &c. When the furnace is raised to a proper heat, the compartment at the flue end, or No. 1, being a black red heat, the next compartment, No. 2, somewhat hotter, and No. 3, or that at the grate end, of a bright red heat, the mixture of ore and carbon (by preference charcoal) is introduced through the hopper into No. 1. It is then stirred with iron tools (such as are used by puddlers) for about an hour and a half, when it is turned into the next compartment, and No. 1 immediately charged again. The charges are then passed through all the compartments in succession, and remain in each for an hour and a half; and according to this system the process may go on continuously, each charge being worked altogether about four hours and a half, which has been found to be sufficient to complete the deoxidation. The deoxidized ore or iron, after removal from the furnace, is balled up in the puddling furnace in the ordinary manner; but if it should be found to have a tendency to form itself into lumps it is submitted to a grinding or pounding process, and, when reduced to powder, passed through the puddling furnace and balled up, as is well understood. The balls when removed from the furnace are made into blooms, or hammered into cakes, plates, or bars, which are afterwards cut up and converted in the converting furnace; or they may be charged at once with the requisite degree of carbonization for steel of any temper, by adding carbon (in the shape of charcoal) in the crucible or melting operation.

The patentee does not claim the exclusive use of the furnace described, except when employed for the purpose of his invention; but he claims the improvement in the manufacture of steel from ores and other oxides of iron deoxidized at successive temperatures, as above described.

Improvements in obtaining light and heat, and in apparatus connected therewith. GEORGE HENRY BACHOFFNER, of Grove-road, St. John's-wood, and NATHAN DEPRIES, of Grafton-street, Fitzroy-square, civil engineers. Patent dated December 19, 1850.

1. The patentees describe a method of applying springs to the wicks of hollow moulded candles, in order to draw down the wick while the candle is burning, and thus obviate the necessity of snuffing. The wick is attached by a piece of binding wire to a vulcanized India-rubber ring, which is then drawn through a stem of non-conducting materials, and introduced into the candle, the hollow in the top of which is in the first instance made in the form of an inverted cone. The ring is now drawn down by a hooked wire, introduced through the hollow in the candle, and made fast at the bottom by a piece of wood passed through it and resting on the bottom of the candle. By this arrangement the wick is drawn down gradually as the candle is consumed.

2. This part of the invention relates to a method of obtaining from gas the solid incandescent appearance of an ordinary coal fire. The patentees employ a fire-grate with horizontal tubes, perforated with numerous jet holes, or bars covered with wire gauze; and they fill up the grate with clippings or parings of metal, or with spongy platina, so as to produce the desired effect. A substance very suitable for use instead of the latter is prepared by mixing solutions of 125 parts sulphate of copper, 152 parts bichromate of potash, and 39 parts carbonate of ammonia. A brown precipitate (basichromate of copper) will be thrown down, which when submitted to a red heat in a crucible, forms a spongy or cellular mass, which does not oxidize under the in-

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fluence of continued heat, and is therefore well adapted for this purpose. When burning diluted gas, the patentees pass it through sheets of talc or platina perforated with numerous holes, taking care to have not less than thirty such holes to the square inch; or, they cause the gas to ascend through a heap of iron bullets, varying in size from one-eighth to half an inch in diameter, and they ignite such gas after it has issued from the jet-holes and become intermingled or diluted with atmospheric air.

3. The patentees manufacture conical-shaped shades for lamps and candles by attaching strips, plates, or prisms of plain or ground glass, or polished metal, or tubes of glass silvered on the interior, to suitably-formed frames, by means of wire. They prefer that the strips, or plates, or tubes should be wider at one end than the other, in order to accommodate themselves to the shape of the shade, but do not confine themselves to any particular form.

Claims.—1. The use of springs to draw down the wicks of candles.

2. The mode of and apparatus for burning gas for heating, as described.

3. The improvements in shades for lamps, as described.

Improvements in the concentration of sulphuric acid and certain other fluids; also in the use of a certain product, or certain products, sometimes obtained in manufacturing sulphuric acid and sulphates. WILLIAM HERBERT GOSSAGE, of Stoke Prior, Worcester, chemist, Patent dated December 20, 1850.

The peculiar feature of the first branch of these improvements is, that the liquid undergoing concentration is diffused in films over a vast number of surfaces, and exposed to the evaporative action of a current of heated air. The apparatus employed consists of a tower or shaft, filled with siliceous pebbles, and communicating at bottom with an apparatus for heating air, or, in certain cases, directly with a furnace. The liquid is supplied from above through a bed of sand and pebbles, and acted on by the ascending current of air as it percolates through the pebbles in the tower. The apparatus is applicable to the concentration not only of sulphuric acid, but also of saccharine juices and saline solutions of different kinds such as those of copperas, &c.

The second part of the invention relates to certain methods of obtaining sulphate of alumina, alum, and salts of iron and copper by the use of the material known as "burnt pyrites," which consists principally of peroxide of iron, but also generally contains copper, but in various proportions.

In order to obtain potassa-alum, the patentee takes 200 parts of burnt pyrites containing copper, reduces it to fine powder, and adds thereto 22 parts of chloride of potassium, 80 parts of raw pyrites containing about 35 per cent. of sulphur, and 80 parts of clay containing 85 per cent. of alumina, with sufficient water to give the mixture cohesiveness. He then moulds it into balls about half the size of a man's fist, which he dries and submits to heat in a furnace of similar construction to that usually employed in the manufacture of sulphuric acid from pyrites, but of at least twice as great depth, adding at the same time sufficient coal and coke to maintain combustion and raise the balls to a red heat. At the expiration of about six hours a part of the charge is withdrawn from the furnace and lixiviated in boiling water, to which is added 4 parts of oil of vitriol to every 100 parts of balls. A solution is thus obtained containing potassa-alum, copper and iron. The copper is precipitated by metallic iron, after which the alum is separated by crystallisation, and may be refined for sale or use. The mother liquors of this evaporation contain protochloride of iron, which may be obtained by concentration and crystallisation, when the spent liquors may be advantageously employed, instead of water, in treating a second batch of the calcined mixture. By substituting common salt for chloride of potassium, soda-alum may be procured. The process is in other respects the same.

If sulphate of alumina is desired to be produced, then the same mixture as that above described for potassa-alum, with the omission of chloride of potassium, is to be prepared and burned in a similar manner. The balls are then lixiviated with hot water and sulphuric acid, as before mentioned, when a solution will be produced containing sulphate of alumina, sulphate of iron, and sulphate of copper. The latter is precipitated by metallic iron; and as this part of the operation will convert the iron in the solution to a protosalt, it is to be exposed to atmospheric air (for which purpose the apparatus described under the first head of the specification is recommended as being very suitable), in order to convert the protosulphate to persulphate of iron. The solution has then just sufficient cream of lime added to it to combine with the persulphate; and after the sulphate of lime and peroxide of iron thus formed have subsided, the clear liquor is drawn off and crystallised, to obtain solid sulphate of alumina, or it may be

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treated with an alkaline sulphate, and alum produced in the ordinary manner of such manufacture.

To obtain the sulphates of iron and copper from burnt pyrites, it is mixed with one-fifth part of raw pyrites and sufficient moistened clay to provide for its being made into balls, which are burnt as before directed, and after the addition of 8 per cent. of oil of vitriol, lixiviated in boiling water, and a solution obtained holding in suspension protosulphate of iron, persulphate of iron, and sulphate of copper. After precipitating the copper by metallic iron, the solution is evaporated, and the remaining product (sulphate of iron) obtained by crystallisation in the ordinary manner.

Claims.—1. The construction of apparatus for effecting the concentration of sulphuric acid and certain other fluids, which apparatus is so arranged that the fluid undergoing concentration is caused to flow in films over an immense number of surfaces, and so that the concentration may be effected by the evaporative action of currents of heated air coming in contact with the films of fluid as it flows over such surfaces.

2. The use of the material known as "burnt pyrites," for the production of sulphate of alumina, alum, and sulphate of iron, or some of these compounds, by mixing this material with raw pyrites and clay, and operating on the mixture or mixtures so produced in the manner described.

3. The extraction of copper, or salt of copper, from the material known as "burnt pyrites," at the same time that sulphate of alumina and sulphate of iron are obtained by the use of this material in the manner described.

DIRECTIONS FOR USING MR. F. SCOTT ARCHER'S PREPARED COLLODION FOR OBTAINING INSTANTANEOUS POSITIVE AND NEGATIVE PICTURES.*

COLLODION, as most people are aware, is a solution of gun-cotton in ether, and, for the purpose now under consideration, should contain a small quantity of iodide of silver, dissolved in iodide of potassium. It should be sufficiently limpid to run freely over a plate when poured on, or ether must be added until this result is obtained. If the collodion be too thick, great difficulty will be experienced in obtaining an even coating, but when of a proper consistency, plates of any size may be coated. The plan which I have adopted, and with great success, is as follows:—Take a piece of flat glass, cut to the size of frame, and having washed it with water and wiped the same quite dry, then, while holding it at one corner, or, if large, placing it on a levelling stand, pour on the centre of the plate a good body of the prepared collodion, which will readily diffuse itself equally over the surface. Immediately pour the liquid off again into the bottle from one corner, and by bringing the hand holding the plate down a little, that the liquid may run to the lower edge, and drawing the mouth of the bottle along; those lines first formed will run one into the other, and give a flat even surface. Very little practice will soon enable any operator to obtain this result. The plate is now immediately, and before the whole of the ether has had time to evaporate, to be immersed in a bath of nitrate of silver (30 grains to the ounce of distilled water), until the greasy appearance which it first presents on immersion is entirely gone and the silver solution flows freely over the surface, and in its moist state be placed in the camera and the picture taken, the time of exposure varying of course with the light, but for a portrait and with a moderately quick lens from 3 to 30 seconds will be sufficient. Mr. Fry, who was the first to practise with the Collodion, has obtained beautiful portraits by placing the sitter in the open air, and simply removing the cap from the lens and closing it again as soon as possible. The agent for developing these pictures is the pyro-gallic acid, as recommended by Mr. Archer, and I am told the proto-nitrate of iron also answers equally well. The solution of pyro-gallic acid should be made as follows:—

Pyro-gallic acid.....	3 Grains.
Glacial ascetic acid.....	1 Dram.
Distilled water.....	1 Dram.

The plate, after being exposed in the camera, is to be placed face upwards upon a levelling stand, and a sufficient quantity of the above solution should be poured equally and quickly over the surface, and the picture allowed to develope, occasionally moving the plate to prevent any deposit from settling at one spot. A few drops of a solution of nitrate of silver, five grains to the ounce may also in dull weather be added to the pyro-gallic with advantage, just before pouring it over the plate; but

* Extracted from a communication by Mr. F. Horne, to Robert Hunt, Esq., and published in the *Art Journal* of July, 1851, No. 157.—Sold by Horne, Thornthwaite, and Wood, Optical and Philosophical Instrument Makers, 121 and 123, Newgate Street, London.

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in very bright weather the picture will develope sufficiently quick with the pyrogallic acid solution alone. The developement may be readily judged of by holding a piece of white paper occasionally under the plate, and as soon as sufficient intensity has been obtained, the solution must be poured off, and the plate washed by a gentle stream of water; after this the surface should be covered with a saturated solution of hyposulphite of soda, which will almost immediately remove the undecomposed iodide and fix the picture, and another stream of water must then again be poured over to free the plate from hyposulphite, and the picture is finished.

In this state they are more or less negative by transmitted light, and if not too much brought out, positive, by reflected light. But I have found the most beautiful and decided positives may be obtained by the simple addition to the pyro-gallic solution of a minute quantity of nitric acid, care being taken not to add too much; I have also obtained purple and green pictures; the former, by adding acetate of lead, and the latter, with acetate of lime with ordinary gallic acid.

The pictures thus obtained may be treated as negative pictures, and printed from by any of the methods employed to obtain positive pictures from paper negatives.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

THE WATER QUESTION.—THE HARDNESS OF WATER. THE ERROR OF "THE SOAP TEST."

BY CHARLES WATT.

It appears that the Government has at length brought forward a measure in connection with the question which has for so long a period occupied the serious attention of the public, and it is by no means to the credit of those by whom the business of the country is carried on that there should have been so much delay in attending to the wants of this large metropolis. Whether or not the public will derive any real benefit from the measure proposed by the Government, I shall not take upon myself to judge, but content myself with observing that it does not appear to have been received with anything like satisfaction; and most people seem to think that, in an economical point of view, we shall be worse off than at present. I hope, however, that the water will be of better quality; it is now, for use as a beverage, or for culinary purposes, filthy, disgusting, and loathsome in the extreme;—injurious to those who consume it, and a disgrace to those who supply the public with it at enormous charges.

During the last six years, I have paid much attention to water with regard to its fitness for cleansing, for culinary purposes, and for use as drink, and I hope the following observations may not be uninteresting to the readers of this journal.

About two years ago, it was my intention to have published some analyses which I had made of the Artesian water of the London chalk basin, of the water taken from the Thames, near London-bridge, at high-water, and the New River water; and as these analyses were made upon large quantities of water, (twelve gallons and upwards) and as, moreover, I had adopted a process which enabled me to isolate the components so as to be able to show each separate constituent, I thought the analyses might have more than usual claims to the confidence of the public;—but I unfortunately lost the notes while travelling, and having no copy of them and being very much engaged professionally at the time, I was unable to devote time to re-perform the analyses.

In reading the evidence given by Prof. Brande, I was gratified to see that he attempted to remove the erroneous impression conveyed by Dr. Clarke's system of stating the hardness of water by degrees, each degree being 1 gr. carbonate of lime in a gallon of water. The characteristic of hard water is, that when a solution of soap is added to it a curdy precipitate is formed: upon this all are agreed, and that if there is much carbonate of lime or magnesia in water that the addition of a solution of soap will cause a deposit no one doubts; but that it is the hardening principle in all or even in most waters, is a very erroneous conclusion. The mode in which the soap acts is thus:—All soap contains a little free alkali; this, taking the carbonic acid which holds the lime or magnesia in solution, causes it to deposit, and, doubtless, in its deposition, a little of the soap is also carried down: but when

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the chlorides or sulphates of lime and magnesia exist in water, a double decomposition takes place, and an insoluble lime or magnesian soap is formed. I have repeatedly proved this fact, and have had several opportunities of ascertaining its correctness on a large scale, having been consulted by parties using soap extensively for scouring goods in the manufacturing districts. Again in the case of the incrustation of boilers, it is the *sulphate* of lime which does the chief part of the mischief; where carbonate of lime or magnesia exist alone, which is rarely the case, then the introduction into the boiler of the muriate of ammonia, will effect the object, as by the double decomposition which is set up volatile carbonate of ammonia and soluble chloride of calcium are formed; but if such waters contain any alkaline sulphate when the evaporation has been carried beyond the point at which the sulphate of lime is soluble, double decomposition is again at work, and sulphate of lime is formed and precipitated.

While discussing this part of the subject, I may mention that, some years since, while making some analyses of sea-water, I became impressed with the fact that by the ordinary method of evaporating a water down, and examining the residue, we acquire but very little information as to the real state in which these salts exist. I am perfectly aware that the idea is not original with me. I think that Dr. Murray first called attention to it; but I have perfectly satisfied myself that sulphate of soda and chloride of calcium are not incompatible in a solution, that they do not decompose each other unless they are in such a state of concentration that the sulphate of lime was insoluble; this point I determined, as well as some others connected with it, by a method which I shall not be able to enter into fully on the present occasion, but hope to have leisure to do so at a period not far distant, when I expect to be able to point out a means by which we may at all times be able to determine the precise state in which the saline substances in any water exist, and which will, I trust, tend to remove some of the difficulties which now attend the use of water in some processes of the arts, as well as its effects on boilers.

I may here mention, that on looking over some of the analyses published within the last two years of some of the Artesian water, I find that some of the analysts have stated that that of London contained sulphate of potassa; on paying a visit to the establishment at the back of Trafalgar Square, I found a small leakage in one of the pipes of the boilers which supply the steam-engine, and the water had fallen, drop by drop, for some time upon the boiler, and, being evaporated by the heat, a large lump of dry saline matter had collected. This lump, which weighed about a pound, I removed, and took to my laboratory: it contained no sulphate of potassa. I was enabled to separate the salts pretty nearly by crystallisation, and found it to consist of carbonate and sulphate of soda, chloride of sodium, and small portions of carbonate of lime and magnesia, and silica.

I also analysed two separate quantities (twelve gallons each) of the water which was drawn from the pipe through which it is pumped and as it was being pumped, and also failed in detecting any amount of sulphate of potassa.

The method of analysis which I adopted was the following, and I have adopted it in many other cases, varying it a little according to the results previously obtained in a rough qualitative examination.

The weight of the saline residue, carefully dried at a temperature of about 300° F. being ascertained, it was dissolved in distilled water and freed from the insoluble earthy matters; the saline solution was then boiled with a little excess of very pure lime, which rendered the carbonated alkali caustic. The solution being carefully separated from the carbonate of lime was quickly evaporated to dryness, and treated with absolute alcohol; the alcoholic solution was then poured off, and the insoluble portion washed once or twice with alcohol; these alcoholic solutions were mixed, and a solution of pure carbonate of ammonia being added, were boiled down to dryness and carefully heated to redness, and then raised to a temperature of about 500° F.; this gave the weight of the carbonate of soda existing in the water. The portion which was insoluble in the alcohol was dissolved in water freed from the carbonate of lime, and treated with a solution of pure caustic baryta, added very carefully, so as to have the slightest possible excess, which was accomplished by keeping back a little of the saline solution and adding it drop by drop. The solution of baryta precipitated the sulphuric acid. The saline solution being carefully poured off and the precipitate washed, the washings and saline solution being evaporated to dryness very quickly, the residue was treated as before with absolute alcohol, and the insoluble saline portion washed with alcohol; these alcoholic solutions being mixed together were treated with an excess of a solution of sulphate of ammonia, evaporated, and heated to nearly dull redness to drive off the excess of sul-

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phate of ammonia, gave the weight of the alkaline sulphate, which could be verified by the weight of the sulphate of baryta when dried. Thus, by following this plan, we have a double method of ascertaining the accuracy of the results, and are enabled to determine by the weight of the sulphate of baryta and the alkaline sulphate whether the alkali is potassa or soda, or both. The chloride of soda was now left contaminated with a very little baryta, and being redissolved and boiled, the baryta was precipitated, and the solution being poured off and evaporated to dryness gave the weight of the chloride of sodium.

With some precautions, which will be evident to those accustomed to such operations as these, I found this method of analysis susceptible of accuracy, and I think that it may be frequently with advantage adopted in lieu of the methods by which it is very evident that some of the more recently-published analyses have been performed; at any rate, it has this advantage, that we may separate the constituents so as to be able to show each of them in separate vessels, which is always a matter of satisfaction, if only to ourselves.

In leaving this subject I cannot help remarking how well adapted the Artesian water seems to be for some purposes—perhaps especially for brewing porter, and I have observed that wherever good porter is made, in the water of that locality, so far as my experience goes, minute portions of alkali exist: this is the case in Dublin, where the decomposing granite mountains supply the alkali.

I cannot help expressing an opinion that too much importanec has lately been attached to the freeness of water from carbonate of lime. I do not think that we are in possession of any facts that can be relied upon to prove that it is unwholesome, and that in studying this part of the subject the diet of the people should be taken into consideration, in conjunction with the water, climate, and many other circumstances, before we can arrive at anything like a sound conclusion; and that for the purposes of the arts and for cleansing, freedom from sulphate of lime is of more importance.

In a sanitary point of view, I think, that the chief thing that we have to take care of is, that we do not contaminate water with organic matters,—a part of the subject which ought to have been looked to long since.

In an article published by Dr. John Smith, upon the composition of the waters of the Dee and Don, (*Quarterly Journal of the Chemical Society*, July 1, 1851), reference is made to what he calls Dr. Clarke's soap test. Who first employed or suggested this test I cannot say, but it has been in use for very many years. I have myself used it at any rate 12 years since, and have been convinced for more than 6 years of that time that it is worthless. There is no true chemical decomposition between margarate and oleate of soda (soap) and a solution of carbonate of lime; the reverse action would be from the order of affinities what would take place, viz., that carbonate of soda would decompose margarate and oleate of lime.

When sulphate of lime exists in water, sulphate of soda is formed by the addition of a solution of soap and lime: soap is the other product.

It will be found, practically, that for every grain of sulphate of lime existing in any quantity of water, about 8 grains of ordinary soap is decomposed and thrown out of solution; and it is because this waste is so great from the presence of sulphate of lime that I urge the necessity, when water is to be used for cleansing purposes, of considering what quantity of sulphate or other soluble salt of lime or magnesia (not carbonate) which it may contain.

The foregoing observations will point out the object and advantage of adding small quantities of carbonate of soda to hard water previous to using it for cleansing. Carbonate of lime is precipitated, and sulphate of soda remains in the solution, which, in the state of dilution, is without effect upon the solution of soap.

A BILL FOR REGULATING THE QUALIFICATIONS OF PHARMACEUTICAL CHEMISTS, AND FOR OTHER PURPOSES IN CONNEXION WITH THE PRACTICE OF PHARMACY.

WHEREAS, it is expedient for the safety of the public that persons exercising the business or calling of Pharmaceutical Chemists, Chemists and Druggists, or Dispensing Chemists in Great Britain, should possess a competent practical knowledge of Pharmaceutical and general Chemistry, and with other branches of useful knowledge: And whereas, certain persons desirous of advancing Chemistry and Pharmacy, and of promoting an uniform system of education of those who should practise the same, formed themselves into a Society, called "The Pharmaceutical Society of Great Britain," which said Society was, on the eighteenth day of February, one thousand

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eight hundred and forty-three, incorporated by Royal Charter, whereby it was provided that the said Society should consist of Members who should be Chemists and Druggists who were or had been established on their own account at the date of the said Charter, or who should have been examined in such manner as the Council of the said Society should deem proper, or who should have been certified to be duly qualified for admission, or who should be persons elected as Superintendents by the Council of the said Society: And whereas it is expedient to prevent ignorant and incompetent persons exercising the business or calling of Pharmaceutical Chemists, Chemists and Druggists, or Dispensing Chemists, in Great Britain, and to that end it is desirable that all persons, before exercising the said business or calling: And whereas, for the purpose aforesaid, and for extending the benefits which have already resulted from the said Charter of Incorporation, it is desirable that additional powers should be granted for regulating the qualifications of persons who may carry on the business of Pharmaceutical Chemists, Chemists and Druggists, or Dispensing Chemists, and for other purposes connected with the practice of Pharmacy: be it enacted by the Queen's most excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same,

I. That the said Charter of Incorporation granted to the said Society on the eighteenth day of February, one thousand eight hundred and forty-three, save and except such part or parts thereof as are hereby altered, varied, or repealed, shall be and the same is hereby confirmed, and declared to be in full force and virtue, and shall be as good and effectual to all intents and purposes as if this Act had not been made.

II. The Council of the said Pharmaceutical Society shall within (*three*) calendar months after the passing of this Act appoint a fit and proper person as a Registrar under this Act; and the Council of the said Society shall have the power to remove the said Registrar, or any future Registrar to be appointed under this Act, from the said office, and from time to time to appoint a new Registrar in the room of any Registrar who may die, or retire, or may be removed from office as aforesaid, and also to appoint and remove from time to time a Deputy Registrar and such Clerks and other subordinate officers as may be requisite for carrying out the purposes of this Act, and also to pay suitable salaries to the said Registrar, Deputy Registrar, Clerks, and Officers.

III. The Registrar to be appointed under or by virtue of this Act shall from time to time make out a complete Register of all persons carrying on the business of or being employed as Pharmaceutical Chemists, Chemists and Druggists, or Dispensing Chemists, who shall, in writing addressed to the said Registrar, desire to be entered upon the List of Pharmaceutical Chemists, Chemists and Druggists, or Dispensing Chemists, and shall also furnish such evidence of their being so employed as may from time to time be required by the Council of the said Pharmaceutical Society of Great Britain.

IV. The said Registrar shall from time to time keep a proper Index of the Register, and all such other Registers and Books as may be required by the Council of the said Society, and may be necessary for giving effect to the Byelaws of the said Society, and to the provisions of this Act.

V. The Registrar to be appointed under or by virtue of this Act shall be bound, on the application of any person paying one shilling, to certify under his hand whether or no any person whose name and address shall be furnished to him appears in the said Register, or is a Member of the Pharmaceutical Society of Great Britain, or not; and the Certificate of such Registrar, signed by the said Registrar, and attested by two or more witnesses, shall, in the absence of evidence to the contrary, be sufficient evidence of the facts therein stated up to the date of the said Certificate.

VI. All such persons as shall at the time of the passing of this Act be Members or Associates of the said Pharmaceutical Society of Great Britain, according to the terms of the said Charter of Incorporation shall be entitled to the fee; and every other person who shall, within *one year* after the passing of this Act, present, or cause to be presented to the said Registrar a Certificate, and sufficient evidence that such person did at the time of the *passing of this Act* exercise the business or calling of a Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist, in Great Britain, shall be entitled to be registered, without the payment of any fee; and the said Registrar is hereby required to cause the names of all such persons as shall be registered as aforesaid to be entered in a list or book provided for that purpose, as Pharmaceutical Chemists, Chemists and Druggists, or Dispensing Chemists.

VII. Every person who shall at the time of the *passing of this Act* be engaged or

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employed as a Student, Apprentice, or Assistant to any Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist, in Great Britain, and who shall within one year after the passing of this Act present or cause to be presented to the said Registrar a certificate and satisfactory evidence that such person was at the time of the passing of this Act so engaged or employed as last aforesaid, shall be entitled to be registered without the payment of any fee; and the said Registrar is hereby required to cause the names of all such persons as shall be registered as aforesaid to be entered in a list or book provided for that purpose as Students, Apprentices, or Assistants, as the case may require.

VIII. All such persons as shall from time to time be appointed under or in pursuance of the said Charter of Incorporation, or the byelaws thereof, or under this Act, shall be, and the same are hereby declared to be fit and proper persons to conduct all such examinations as are provided for or contemplated by this Act, and shall respectively have full power and authority and are hereby authorised and empowered to examine all persons who shall present themselves for examination under the provisions of this Act, in the Latin Language and Classical Knowledge, in Botany, in Materia Medica, and in Pharmaceutical and General Chemistry, and Toxicology, any or either of them, and to grant or refuse to such persons as in their discretion may seem fit, Certificates of competent skill and knowledge and qualification to exercise the business or calling of Pharmaceutical Chemists, Chemists and Druggists, or Dispensing Chemists, or, as the case may require, to be engaged or employed as Students, Apprentices, or Assistants respectively.

IX. The Council of the said Pharmaceutical Society shall be and the same are hereby authorised and empowered to alter and amend the byelaws of the said Society made and established under or in pursuance of the said Charter of Incorporation, and to make and establish such new or additional byelaws as they shall deem proper and necessary for the purposes contemplated by the said Charter or by this Act; provided that all such altered, amended, or additional byelaws shall be confirmed and approved by one of Her Majesty's principal Secretaries of State.

X. Every person who shall have been examined by the persons appointed as aforesad, and shall have obtained a Certificate of Qualification from them, shall be entitled to be registered by the Registrar, according to the provisions of this Act, upon production to him of such Certificate and upon payment of such fee as shall be appointed in pursuance of the provisions of this Act; and every person duly registered as a Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist, shall be eligible to be elected as a Member of the said Society; and every person duly registered as an Assistant to a Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist, shall be eligible for admission as an Associate of the said Society; and every person duly registered as a Student or Apprentice to a Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist, shall be eligible for admission into the said Society, according to the byelaws thereof.

XI. Except as hereinbefore provided, no person shall be entitled to be registered under this Act unless and until he shall have obtained a Certificate of Examination as hereinbefore mentioned from the persons so appointed as aforesaid: Provided always, that it shall be lawful for the Council of the said Society, at any time within five years from the passing of this Act, to suspend, dispense with, or modify, in such manner as the said Council shall think just, the provisions hereinbefore contained respecting the examination of persons under this Act in favor of any person who at the time of *passing this Act*, shall be serving or shall have served an Apprenticeship to any Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist.

XII. That from and after the end of *one year* from the passing of this Act it shall not be lawful for any person, not being duly registered according to the provisions of this Act, to exercise the business or calling of a Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist, in any part of Great Britain, or to use the name or title of Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist, or any other name, title, sign, token, or emblem implying that he is registered under this Act, or entitled to carry on or exercise the business or calling of a Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist; and if any person, not being duly registered under this Act, shall, after the end of *one year* from the passing of this Act, take or use the name or title of Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist, or shall use, display, or exhibit any name, title, sign, token, or emblem implying that he is a person registered under this Act, or entitled under this Act to carry

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on or exercise the business or calling of a Pharmaceutical Chemist, Chemist and Druggist, or dispensing Chemist, every such person shall forfeit and pay for every such offence a sum not exceeding *(twenty pounds)* nor less than *two pounds;* and such penalty may be recovered by the Registrar to be appointed under this Act, or any Member of the Council of the said Society, in manner following; that is to say,

In England or Wales either by an action of debt or on the case against the party offending, commenced by writ of summons in the superior courts at Westminster, or by plaint under the provisions of any Act in force for the more easy recovery of small debts and demands:

In Scotland, by action before the Court of Session in ordinary form, or by summary action before the Sheriff of the County where the offence may be committed or the offender resides, who, upon proof of the offence or offences, either by confession of the party offending, or by the oath or affirmation of one or more creditable witnesses, shall convict the offender, and find him liable in the penalty or penalties aforesaid, as also in expenses; and it shall be lawful for the Sheriff, in pronouncing such judgment for the penalty or penalties, and costs, to insert in such judgment a warrant, in the event of such penalty or penalties and costs not being paid, to levy and recover the amount of the same by poinding:

Providing always, that it shall be lawful to the Sheriff, in the event of his dismissing the action, and assoilzing the defender, to find the complainer liable in expenses; and any judgment so to be pronounced by the Sheriff in such summary application, shall be final and conclusive, and not subject to review by advocation, suspension, reduction, or otherwise.

XIII. Provided always, That no action or other proceedings for any offence under this Act shall be brought after the expiration of *two months* from the commission of such offence; and in every such action or proceeding the party who shall prevail shall recover his full costs of suit or of such other proceeding.

XIV. All and every sums and sum of money which shall arise from any conviction and recovery of penalties for offences incurred under this Act shall be paid to Her Majesty.

XV. If any Registrar under this act shall wilfully make or cause to be made any falsification in any matters relating to any Registrar or Certificate aforesaid, every such offender shall be deemed guilty of a misdemeanor, and shall, on conviction thereof, be sentenced to pay a fine not exceeding *twenty* nor less than *two pounds.*

XVI. If any person shall wilfully procure by any false or fraudulent means a Certificate purporting to be a Certificate of Registration under this Act, every such person so offending shall be adjudged guilty of a misdemeanor, and it shall be lawful for the Court before whom such offender shall be tried and convicted to sentence such offender to pay a fine not exceeding *twenty* nor less than *two pounds.*

XVII. Provided always, That nothing in this Act contained shall extend or be construed to extend to lessen, abridge, or defeat, or in anywise to interfere with any of the rights, authorities, privileges, and immunities heretofore vested in and exercised or enjoyed by either of the Universities of Oxford or Cambridge, the Royal Colleges of Physicians or of Surgeons of England, Scotland, or Ireland, or the Society of Apothecaries of London, or of any person or persons who may now be or hereafter may become entitled to practise as an Apothecary or Apothecaries under an Act of Parliament passed in the fifty-fifth year of his Majesty King George the Third, intituled "An Act for better regulating the Practice of Apothecaries throughout England and Wales," or any other legally qualified medical practitioners, but that the said Universities and Royal Colleges, and the said Society of Apothecaries, and all such person or persons as aforesaid, shall have, use, exercise, and enjoy all such rights, authorities, privileges, and immunities as aforesaid, in as full, ample, and beneficial a manner to all intents and purposes as they might have done in case this Act had never been passed.

XVIII. Provided also, That the several persons who by virtue of the clause last aforesaid are expressly exempted from the operation of this Act, shall not in the conduct of their several professions or occupations use or assume the name or title of Pharmaceutical Chemist, Chemist, and Druggist, or Dispensing Chemist, or any name, title, or designation implying that they are persons registered under this Act, and if any person shall act contrary to this present provision, such person shall not be entitled to the exemption provided for by the Clause last aforesaid.

XIX. Provided always, That nothing in this Act contained shall extend or be construed to extend to affect or in anywise

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interfere with the trades, business, or occupations of Drysalters, Vendors of Drugs or Chemicals used for other than medicinal purposes, or Makers, Compounders, or Vendors of any stamped, patent, or proprietary Medicines, or of Horse or Cattle Medicines, but that all such persons respectively shall be entitled to carry on their respective trades, business, or occupations in the same manner to all intents and purposes as they respectively might have done in case this Act had never been passed, subject to the condition that in so doing no such person shall assume the name or title of a Pharmaceutical Chemist, Chemist and Druggist, or Dispensing Chemist, or use, display, or exhibit any name, sign, token, or emblem, implifying that he is a person registered under this Act.

EXPERIMENTAL RESEARCHES ON THE MODIFICATIONS CAUSED IN THE ANIMAL TEMPERATURE BY THE INTRODUCTION INTO THE ECONOMY OF VARIOUS THERAPEUTICAL AGENTS.*

BY MM. AUGUSTE DUMERIL, DEMARQUAY AND LECOINTE.

EXCITANTS. This class of medicaments was experimented on with care; but we have devoted our attention only to those whose action is powerful; the others, which are very numerous, have been neglected.

The substances experimented on were cantharides, cinnamon, sulphate of quinine, ergot of rye, acetate of ammonia, phosphorus and strychnia.

Cantharides. Four experiments were made with cantharides; they were given in the doses of 0·08gr., 0·20gr., and 0·40gr. With the dose of eight centigrammes the thermometer rose above 2°. 1′ C, in a period of six hours, during which time the temperature was taken every two hours.

In three other experiments, made in the same manner and with as much care, and in which we twice gave 0·20 gr. and once with 0·20gr., but which did not exceed 1° C. (1°·8 F.) We shall see, in the course of this work, that cantharides is not the only substance which gives different and even contrary results with varied doses.

Cinnamon. We have made three experiments with this medicament. It was given in decoction, twice in the dose of 30 grammes, and once in the dose of 45 grammes. The animals were experimented on at between 0·40gr. we likewise obtained an increase of temperature approaching 2°C., (3°·6 F.) 10 and 11 o'clock in the morning; their last temperature was taken at 11 o'clock at night. In the dose of 30 grammes, in two animals, cinnamon caused an increase of temperature of 1°·7 C. (3°·56 F.), whilst with 45 grammes the temperature rose to 2°·7 C. (4°·8 F.); here then, the elevation was in the direct ratio of the dose administered, and the action of the latter remained until the 11th hour of the experiment.

Ergot of rye.—This substance, whose specific properties as an excitant of uterine contractions are so well known, was given, once in the dose of 4 grammes, and in a period of five hours, during which time the temperature was taken several times; we observed an increase of 8 tenths of a centigrade degree (1°·44′ F.)

Acetate of ammonia.—We made six experiments with acetate of ammonia. Five times it was introduced into the stomach, and once into the veins; in the stomach, in the dose of 5, 10, 20, and 30 grammes, the temperature was always increased, not only when it was introduced into the system by this way, but also when injected into the veins. However, the elevation varied thus: 5 grammes of this salt, put into the veins, gave an increase of eight-tenths of a centigrade degree (1° 44′ F.); 5 and 10 grammes administered internally gave as a result 1° C. (1°·8F.), and 1°·3C., (2°·3 F.) The dose of the medicament was afterwards gradually increased, as we have seen above, but the temperature, which was raised, did not exceed the degree given by the previous doses.

Sulphate of quinine.—This medicine was given twice internally in the dose of 1 and 2 grammes. In these two experiments, we have found as a final result an augmentation of the temperature varying from 1°·5 to 2°·2C. (2°·7 to 3°·9 F.) But a phenomenon which should be noticed is, that at the commencement of the experiment, the temperature decreased during the first two hours, several tenths of a degree.

Phosphorus.—Six experiments were made with phosphorus in the dose of 0·02gr. and 0·05gr. There was a constant and successive increase of 1°·7 C. (3°·06 F.) in the first, and 2°·2 C. (3°·9 F.) in the second; whilst in the last four dogs to which the medicine was administered in doses of 0·10gr., 0·15 gr., and 0·20gr., we perceived an uniform but trifling diminution of temperature, not exceeding $\frac{2}{10}$ of a centigrade degree, unless in one which died in 50 minutes. Thus phosphorus in small dose raises the temperature, whilst in a high dose it slightly depresses it.

* *Repertoire de Pharmacie*, May, 1851.

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Sulphate of Strychnia.—We have made four experiments with this substance; twice we gave it internally and twice by the veins. We obtained very little results; the temperature was slightly raised. The animal, moreover, very quickly died under the influence of this reagent.

PROCESS FOR DEPRIVING BALSAM OF COPAIBA OF ITS DISAGREEABLE TASTE AND ODOR, AND ENVELOPING IT WITH A SACCHARINE COVERING UNDER THE FORM OF PILLS OR COMFIT.*

BY M. CHERVET, OF CLERMONT, PNYDE DOME.

THIS process, for which a patent in France was obtained by M. Chervet, consists in putting into a glass or porcelain mortar, the quantity of copaiba to be treated, and in pouring into it sulphuric acid, stirring the mixture with the pestle; decomposition and a development of a powerful odor of copaiba immediately take place; the liquid assumes a garnet color, and solidifies into a mass which may be made into pills.

For this operation to succeed, the copaiba must be very pure; for if it contains castor oil, it does not solidify, but remains liquid and maintains the appearance of a rather thick oil.

When it is adulterated with turpentine, which is frequently the case, solidification takes place; but, when put into water, the mass is covered with a white, resinous substance and has a bitter, disagreeable taste.

The mass, thus solidified, is divided into pills, which are put into powdered starch, then sifted and dried.

The pills, when dried, are put into a confectioner's slaking pan, heated a little, and a few layers of a mixture of gum arabic and gum tragacanth dissolved without heat are added, taking care to dry and perfectly detach the pills with the hand.

The pills thus prepared are placed in an oven, after remaining in which for a day or two the above operation is repeated.

On the third day, they are put into the slaking pan, and covered first with one or two layers of gum, then with a layer gum arabic mixed with sugar of cassonad or syrup.

The addition of this saccharine mucilaginous mixture is continued until the pills are covered with a satisfactory saccharine envelope.

They are then replaced in the oven and exposed to a moderate and regular heat.

Above the fifth day, the pills are gummed with the mixture of finely powdered gum arabic and gum tragacanth; care is taken to move them about carefully in the hand, after which they are made to absorb several layers of syrup well clarified with charcoal, and they are then covered with a slight layer of starch.

On the sixth day, the operation is completed by the glazing, by covering the pills with a layer of very fine sugar, well clarified with animal charcoal, and they are placed in a stove to dry.

The novelty of this process presents three principal advantages:—

1. That of rendering the balsam of copaiba free from disagreeable taste, either during or after having been swallowed.

2. That of retaining all its efficacy, since its active principles are not altered and because we are compelled to employ for this preparation none but very pure copaida.

3. That of being able to detach its adulteration with castor oil and turpentine.

FORMULA.

	Grammes.
Balsam of copaiba	10
Sulphuric acid	4

This quantity of sulphuric acid should be poured very rapidly on to the copaiba, taking care to stir it, as I have said above, with the pestle; it very soon begins to solidify,.

If less acid be added, the mass will retain its odor and taste without solidifying; if more be used, the mass will be too acid.

* *Journal de Chimie Medicale*, July 1851

ON ALOINE, THE CATHARTIC PRINCIPLE OF ALOES.*

BY MESSRS. T. AND H. SMITH.

DURING last summer, having occasion to prepare a quantity of the aqueous extract of aloes, a preparation in repute with many medical men, we made use of cold rather than hot water as the solvent, from an impression that a more perfect, though less bulky product would be obtained by leaving in the marc a large proportion of resinous matter, which must necessarily be contained in the extract prepared from a hot solution. Further, with a view of rendering the preparation as perfect as possible, the filtered

* *Monthly Journal of Medical Science*, February 1841.

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liquid was evaporated *in vacuo*, thereby avoiding an excess of heat, under the influence of which and exposure to the air, recent researches show the cathartic property of the aloes to be seriously impaired.

After the syrupy liquid had cooled, certain appearances arrested our attention, and seemed of sufficient importance to induce a departure from the original intention of forming it into a dry extract. The vessel containing the thin extract was now therefore set aside for a few days; and when again examined, the contents were found to have lost their original liquid state, and to have become loaded with a mass of granular crystalline matter. The whole was at once put into a cloth, and freed from the liquid portion by strong pressure. The crude solid substance left in the cloth being very impure, required further treatment before an opinion as to its nature could be formed, and was therefore dissolved in hot water, and filtered while still hot, out of contact with the air. On the cooling of the liquid, the substance separated in a crystalline state, and of a deep yellow color. After a second pressure, it was subjected to another treatment exactly like the last. The solid cake resulting from the third pressure, after being completely dried, presented the appearance of an opake straw-yellow mass, breaking short and of a dull fracture. Its taste was intensely bitter and distinctly aloetic, but entirely without smell. It was found to be quite combustible, and to leave no ash on being burned on platinum foil. Its solution acted on test-paper neither as an acid nor as an alkali; it was therefore a neutral body. It dissolved in very small quantity in cold water, not above a grain to the ounce, but very readily when heated. It is very soluble in acetic æther, and also in acetic acid, of about 25 per cent., even in the cold; four grs. may be easily dissolved in a fluid drachm of either of these liquids. In lime-water it is considerably more soluble than it is in cold distilled water. Oil of turpentine and chloroform do not appear to have any solvent action on it. It is very readily dissolved by aqua potassæ and other alkaline liquids. In rectified spirit, with the assistance of heat, it dissolves in large quantity; and on very slowly cooling, out of contact with the air, it crystallises in beautiful yellow satiny tufts of rhombic plates. The spirituous solution, however, refuses to give crystals unless above 40 grs. to the fluid ounce of spirit be used. It is therefore very soluble in this menstruum, 12 parts by measure being capable of holding one part in solution. Weak spirit is also a good solvent, for on adding water to a strong alcoholic tincture, there is no separation. Sulphuric æther dissolves it very sparingly.

From a consideration of all these characters, we became satisfied that the substance which had been separated by us from the commercial Barbadoes aloes had never been made known before, and therefore was a new substance; but whether the interest attached to it should terminate here remained to be seen. Of course the first and most important question which suggested itself to the mind, and which remained to be solved, was,—Whether the crystalline substance, which we had now convinced ourselves was an educt, and not a product, from the aloes, possessed any of the virtues of aloes as a medicine, or whether the virtues of aloes were concentrated in it, and depended on its presence for their action upon the living body.

The first trial, with the view of ascertaining its action on the body, was made with ¼ a grain, and it acted 12 hours after being taken, in the manner that so characteristically distinguishes the action of aloes. The same quantity was again given to two healthy young men, with a similar result, except that in one about twenty-four hours elapsed before its operation. In the next two cases, 1 gr. failed to act; but in one of these, the dose having been increased to 2 grs., a very strong operation was the consequence. In a case where 4 grs. were given, the person, a patient of Dr. Robertson, Physician to the Edinburgh Royal Infirmary, had been taking ¼ gr. dose of elaterium with little effect. The operation in this case was rather violent. In numerous other cases in which it was tried, it invariably operated in doses of from one to two grs. The result of these trials was the removal from our minds of every doubt of the crystalline body yielded by the aloes being that on which the cathartic action depended, being, in fact, the active principle of the drug.

To the new crystalline substance we have given the name of *Aloine*. It was obtained, as already stated, from Barbadoes aloes; and it became a question, both interesting and important, to ascertain whether it could be procured from other kinds, such as the Socotrine and Cape. With this view we therefore put these two kinds of aloes under treatment, operating in the very same way as with the Barbadoes, but without success. That the aloine is present in both of these sorts there cannot be a doubt.* In fact, we have no hesitation in

* Since writing the above a vessel containing a solution from the Cape aloes, and

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stating our belief, that we shall yet obtain it from these, the result of what little we have done convincing us of its existence in them as well as in the Barbadoes sort: but by the presence of impurities, chiefly, we suspect, of a resinous nature, the aloine is probably so entangled that it cannot get freedom for that arrangement which seems necessary for ready crystallisation. That a crystalline body may be present, and yet may not crystallise, will, we believe, be readily admitted by any one much occupied with the process of crystallisation. Another cause may, perhaps, be found in ranges and decomposition, originating in faulty processes of preparation, the result of ignorance, carelessness, or fraud. That faulty methods of preparing the aloes may be one cause of certain kinds of the drug not yielding aloine, is rendered probable by the following circumstance which came under our observation. If aloine be crystallised, either from water or rectified spirit, and the crystals left in contact with the mother-liquid, in the course of a few weeks, but more quickly in the latter than in the former case, the crystals will have then entirely disappeared, thus showing the readiness with which the aloine loses its crystallisable character. Keeping these considerations in view, and taking advantage of what little we now know of the properties of the aloine, the following steps were taken:—

The watery solution of Cape aloes having been mixed with a very little sulphuric acid, to separate a quantity of coloring matter along with a fatty acid and chlorophyelle, was filtered, and then evaporated *in vacuo* to a thin extract. The extract was shaken with a quantity of æther, which was then poured off, and allowed to evaporate very slowly. Aloine at length crystallised, but of course from its slight solubility in æther, the quantity was very small; but the thick liquid, which had been washed with the æther, after standing undisturbed for a week or two, was found to have yielded a crystalline crop of aloine considerably more abundant.

The nature of the process by which the presence of aloine in the Socotrine aloes was tested by us was somewhat different from the preceding. A strong alcoholic tincture of the aloes having been prepared, sulphuric æther was added as long as any precipitate was produced. A dark-colored compound of lime being thus taken out of the way, the æthero-spirituous solution, after becoming quite clear, was mixed with a small quantity of water. The result was a separation of the mixed liquids into two distinct portions; the one heavier, composed of most of the water and spirit and a little æther, forming the under portion; and the lighter, consisting principally of æther, but containing a little spirit and water, floating above it. The heavy liquid having been separated, was exposed to a heat of about 130° F., all the spirit and æther had completely separated. The watery solution now left, on cooling, gave crystals having the characteristic appearance of aloine, and a trial strengthened this belief of their nature. The lighter liquid, on slow evaporation, likewise produced similar crystals.

The solutions of aloine are wonderfully altered by the action of the air. One striking experiment made by us will perhaps place this character of aloine in as strong a light as any that could be stated. Two grs. of aloine having been dissolved in two oz. of distilled water, the solution, which was of a very pale yellow color, was corked up in a phial that was nearly filled with it, and then set aside in a heat of about 120° F. The color of the solution gradually passed into a fine red, deepening continually in intensity, till in a few weeks the color had become so deep as almost entirely to obstruct the passage of light.

It may not also be without some interest to mention here the singularly striking effect of nitric acid upon the aloine. ½ a drm. of strong commercial nitric acid being put into a test-tube, and 15 grs. of aloine gradually added, great heat and violent action are produced, with the escape of red fumes, and a perfect solution is the result. The syrupy liquid being now added to cold water, a yellow precipitate is formed, which however dissolves on adding more water; and on neutralising the liquid with aqua potassa, a liquid of a splendid red color is produced. The intensity of the color is so great, that on comparing it with a liquid of equal bulk, and containing the coloring matter of two oz. of cochineal, that colored by the aloine is of a deeper red, and even in the richness of its shade rivals the other. When the liquid is slowly evaporated, tufts of long needle-shaped crystals of chrysammate of potassa are produced.

For an account of the chemical characters

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which has been put aside and remained undisturbed for a long period, has been examined, and found to contain a mass of crystalline matter, exactly of the same appearance as that first obtained from similar solutions of the Barbadoes aloes, which, we feel satisfied, will turn out to be aloine.

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of aloine, we beg to refer to an article by our friend Dr. Stenhouse, in the *London, Edinburgh, and Dublin Philosophical Magazine*, for December last, from a consideration of which it will be quite obvious, that the substance we have obtained from the aloes is quite different from that described by Mr. Edmund Robiquet.

ALLEGED CURE OF HYDROCEPHALUS BY THE USE OF IODIDE OF POTASSIUM.*

BY DR. J. GUERARD.

On the 8th of February last, Mr. J. S. Perry sent in from his plantation to the doctor a colored infant for medical treatment. The mother stated that her child was six weeks old, and had suffered severely during the month from cold, which resulted in an enlargement of the head. On examination, the head was found a third larger than natural, and the sutures were all widely patulous; the fissure commencing at the root of the nose, and extending up the median line of the os frontis to the anterior fontanelle, being an inch across. The fontanelle itself was capacious enough for three fingers. The coronal and sagittal sutures were also widely extended. The scalp covering these broad fissures was puffed and elastic to the touch, and indicated the presence of fluid beneath; dilatation of the pupils and strabismus, together with subsultus tendinum and sudden screaming and tossing of the arms upwards, plainly denoting the nature of the little patient's affection. Also, the bowels were costive, and vomiting frequently occurred. This congeries of symptoms, so clearly evincing a case of hydrocephalus, determined my father at once to try the efficacy of the hydriodate of potass; cases of the undoubted disease having been recorded as cured by this potent drug in the American Journal. He accordingly ordered an ointment consisting of 25 grs. hyd. of potass to the ounce of lard, to be well rubbed over the whole head, twice in twenty-four hours. This to be gradually increased up to 40 grs. to the ounce. At the same time a solution to be made by dissolving 20 grains of the hydriodate in 5j. of rain water, and of this 10 drops to be given morning and evening. This treatment was continued up to the 3d March, and no amelioration of the disease occurring, blisters were now ordered to be applied to the cranium; first on one entire half and then on the other, and so alternating that one side of the head or the other was always under the influence of the epispastic. A couple of grains of the blue mass was likewise ordered twice daily, which kept the bowels in a tolerably active state. Very shortly after, symptoms of anasarca supervening, the unguent was directed to be rubbed over the thorax and the abdomen. And now appeared the crisis of the case, for *a vesicular eruption broke forth over the entire body*, the vesicles bursting and discharging pure lymph. From this critical discharge, the convalescence of the patient commenced, and the remedies being still continued, all the alarming symptoms gradually disappeared. About the middle of July, all remedial measures were discontinued, the case being considered as cured. The child was brought to town, and examined two weeks since, and although there was still some obliquity of vision, I thought I had never seen a healthier and more sprightly looking infant. The sutures were almost all filled up with ossific matter, except the broad space between the two portions of the os frontis, and also the triangular space of the anterior fontanelle; but in both of these there is a hard, bony deposit on the dura mater below, and the cavity will soon be filled up, although not to a level with the superfices of the cranium. The forehead will always be marked with a deep sulcus in the middle. But the absence of all serous effusion from the head, or other parts of the system, and all symptoms denoting pressure on the brain, show that the hydrocephalic affection has been entirely removed, and the cure of the little patient made certain.

* *American Journal of Medical Science.*

SUBNITRATE OF BISMUTH IN LARGE DOSES IN TYPHOID FEVER.*

BY M. ARAN.

M. Monneret had previously noticed the good effects of subnitrate of bismuth in choleriform diarrhœa, and in the diarrhœa of children. M. Aran had administered it in a case of obstinate diarrhœa following typhoid fever: its success was rapid, and in twelve days the patient was able to leave the hospital. It must be mentioned that the patient was convalescent when the subnitrate was administered, and that the completion of the cure was delayed only by this diarrhœa, which continued with much obstinacy. The case, therefore, was one of that diarrhœa which almost always ac-

* *Bulletin General de Therapeutique.*

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companies typhoïd fever towards its termination, and which is most frequently connected with lesion of Peyer's plates, and with an irritated state of the intestinal mucous membrane; for at this period, the utility of alvine evacuations is indisputable, purgatives having the property, if not of abridging its duration, at any rate of preventing or rendering less intense the complications of other organs. But because this diarrhœa, while it continues within certain limits, does not present any special indication, at least of active interference, in the earlier stages of the typhoïd fever, it does not follow that it should be disregarded when it lasts beyond its ordinary term, during recent, or not yet complete convalescence. Sometimes, indeed, after a few days of intense fever, appetite returns, fever diminishes, the tongue becomes moist, the meteorium disappears, the stomach is indolent, and yet the stools continue liquid and frequent, and the patients cannot bear the slightest nourishment. In this state amylaceous lavements containing a few drops of laudanum are ordinarily employed, but often without success. The physician is thus puzzled to raise the strength of the patient; if he allows food, he has to fear enteritis; if he leaves his patient to absolute diet, his strength, instead of increasing, diminishes daily: he should then have recourse to subnitrate of bismuth as a powerful auxiliary.

THE GOOD EFFECTS OF AMMONIA AGAINST THE ULTIMATE CONSEQUENCES OF ALCOHOLIC DRINKS.

BY M. DALLAS, PHYSICIAN AT ODESSA.*

THE good effects of ammonia in intoxication have been long known. The following case seems to prove that these effects are likewise useful against the disorders which more remotely follow the abuse of alcoholic liquors.

I was called in, says M. Dallas, to a commission merchant. He was a Russian, of about forty, long addicted to excess of drinking. I had cured this man of many complaints, at different times; but he said he had not dared to have recourse to me on this occasion, because he had forgotten to reward me for former cures. He therefore sent for another doctor, who had bled and purged him without any benefit. His master at length ordered him to be treated by me.

I found him in great agitation, unable to remain still for a moment, looking from side to side with a terrified air; the eyes injected, the pulse small and frequent.

He spoke to me of an insupportable head ache, of the difficulty he had to read his prayer-book, whereas, before that, he saw quite well; he, in fact, gave me a very exact and very reasonable account of all the symptoms of his illness, and then he added in a low and hesitating voice. "I have still something very important to say to you: I know that you will have no faith, that you will not believe one word of it, and yet I swear to you that it is most true. Each evening, at six o'clock, I hear a peculiar noise; I see come up stairs, one by one, a long file of little devils, who enter my room, who begin to jump and dance, who pull me by the arms, by the feet, who fling themselves on my head, and give me no rest until the morning. I see them," added he, "as I see you, and I call my wife and my son to show them, I make them touch them with their fingers, but they say they see nothing."

His unfortunate wife told me, that in fact, her husband had never closed his eyes for fourteen days, and that he passed the evening and night at war with these devils, whom he constantly sprinkled in vain with holy water, and the rest of the day in talking of the torments endured during the night and of his fears for the following night.

It was not difficult for me to attribute all these extraordinary phenomena to his drunken habits, and in the absence of all other distinct indication, the idea occurred to me of administering to him liquor ammoniæ. He took four drops in each wineglassful of water.

Some days after this treatment, this unhappy man slept first for some hours in the morning, and then even at night; by degrees the devils diminished, then disappeared; his sight improved; at the end of a month, he was perfectly well, and able to return to his employment.

I have seen him lately; it is now more than two months that he has been quite cured and perfectly sober.

* *Journal de Chimie Médicale*, June, 1851.

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THE CHEMIST.

[NEW SERIES.]

I. CHEMISTRY.

NEW METHOD OF EXTRACTING IODINE FROM ITS COMBINATIONS.*

BY SIGNORE EMILIO BECHI, TEACHER OF TECHNOLOGICAL CHEMISTRY, AT FLORENCE.

THE Academy of the Fine Arts of Florence proposed in 1849, as the subject of a special prize, the following question :—

"To find an economical and easy means of extracting iodine, not only from all its natural combinations existing in the soil of Tuscany, but also from every other artificial combination.

"The Academy requires this method to be new or adapted to abridge or rectify the methods already known, that it be available for obtaining, with the matters which constitute the natural combinations or mixtures of iodine, products useful in the arts, and thus opening the way to new manufactures advantageous to Tuscany."

It was to this question that Signore E. Bechi had to reply in the following memoir, which obtained the prize offered by the Academy.

Πασι γαρ ἑυμενὴς ἡ Επιστημη

PLATO.

Perciocche la scienza è per tutti benigna.

The applications of iodine and its compounds, which are daily becoming more numerous, in medicine and the arts, the quantity of this substance which is found naturally in the state of combination in certain springs of Tuscany, demand from science a new means of extracting it which shall unite facility with economy. It is this which has led the Academy to propose for the subject of the triennial prize of this year this interesting question.

The various methods proposed and adopted in France for the extraction of iodine from baths artificially iodised, cannot be used for extracting this substance from its natural compounds in the Tuscan soil, on account of the peculiar conditions in which these compounds exist.

Almost all of these methods, indeed, which are based on the precipitation of iodine in the state of iodide of lead, copper or mercury, would here be incapable of giving satisfactory results, because the waters of Tuscany which contain saline compounds of iodine, besides containing only a very minute quantity of iodine in proportion to the mass of the liquid, also hold in solution several other salts,—chlorides, carbonates, sulphates, &c., which would be decomposed at the same time as the iodides, and would thus uselessly consume large quantities of the reagent and would render the extraction of the iodine so much the more difficult.

The evaporation of these waters by heat might be turned to account, but the quantity of fuel which it would require and the decomposition of the iodides by the metal of the evaporating pans, would render this operation expensive and impracticable.

Spontaneous evaporation would appear preferable at first sight. But if we consider that it could be practised advantageously only in summer, during which season the

* *Journal de Pharmacie*, July, 1851.

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waters of these springs are reserved for medical use, and that during the cold or rainy season, the spontaneous evaporation would be extremely slow, it will be perceived that this method would present numerous difficulties. We may add, that if spontaneous evaporation, or evaporation with the aid of heat, has not been found suitable in France for extracting the iodine from the iodurettted baths, which contain larger quantities than the waters of Tuscany, this method must be so much the less applicable in the latter case.

An endeavor has likewise been made to turn to account the compound which iodine forms with fecula, from which it may be extracted by means of acids and heat, but Signore Targioni-Tozzetti has shown that this means, besides being rather expensive, is impracticable in the large way.

These various considerations have led me to try a quite different method, which appeared to me easier and more economical. Being upheld by many experiments, I flatter myself that I have found a process which fully answers the requirements of the programme of the Academy.

The method which I propose is founded on the property which charcoal possesses of retaining iodine, and afterwards readily yielding it to other substances.

The wonderful property which charcoal possesses of absorbing coloring matters in solution in liquids, discovered by the Russian chemist Löwitz, and afterwards most carefully studied by MM. Bussy, Payen, and Desfosses, has rendered considerable services to industry.

More recently Graham, Lassaigne, Chevallier, Girardin, Warington, Garrod, Weppen, &c., have shown that this property extends not only to the absorption of coloring matters, but also to several inorganic substances, held in solution in liquids.

I have ascertained, indeed, that charcoal removes lime from its solution in water, iodine from its solution in iodide of potassium, the neutral nitrate of lead and all the metallic subsalts operated on, from their aqueous solution, and even from a mixture of this liquid with ammonia; I have likewise proved that this precipitation takes place so completely that the liquid no longer retains a trace of the matter to be absorbed.

Relying on these observations, and applying them to numerous experiments relative to the absorption of iodine, I have been enabled to conclude that this substance, in whatever liquid it may be in solution, is precipitated by charcoal, which fixes it on the surface of its molebules. It would seem to result from some experiments, as we shall see, that a true combination is effected between iodine and mercury; but I am induced to believe that between these two bodies there is really only a simple adhesion. Finally, to show with what accuracy iodine is absorbed or retained by carbon, I may state that having dissolved iodine in distilled water, and having added charcoal, the latter, after the experiment, had increased in weight by the exact weight of the iodine which I had dissolved in the liquid; so that, in certain cases, this process may be used analytically.*

The absorbent action of charcoal on iodine varies according to the substance from which it is obtained, in the same manner as the charcoals resulting from various organic matters act more or less energetically on coloring matters.

In general it may be said that the absorbent power, almost without exception, is in the direct ratio of the decoloring action. I have found that calcined lamp-black possesses a very considerable absorbent power. 1 gramme of iodine, for example, was absorbed in the same space of time by 6 pennyweights of vegetable charcoal, 2 pennyweights of lamp-black, and 1¼ pennyweight of animal charcoal. We know, indeed, that the more finely the charcoal is divided, the greater is its retentive surface; I prefer, consequently, lamp-black, because, besides possessing a considerable precipitating power, it is more economical than animal charcoal.

The charcoal used for precipitating the iodine retains it on its surface with tenacity, in the same manner as a dyed stuff retains the coloring matter.

When charcoal which has absorbed iodine is placed in a retort and strongly heated, only slight traces of iodine are obtained, unless it contains a large proportion. Chlorine, which succeeds so well in separating iodine from so many of its combinations, does not remove it from charcoal, even with the aid of heat. Electricity developed from a powerful voltaic battery does not succeed either, the charcoal in this case appearing to oppose the passage of the fluid. Water, whether cold or hot, does not remove the smallest portion of iodine from the carbon; it is the same with alcohol, which may, however, be regarded as its best solvent; but it is quite different when the iodised charcoal is treated with a substance for which the iodine has great affinity, and which may form with it some intimate combination.

* The author is preparing for publication special researches on this process.

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This fact, which has not hitherto been observed, or put in practice by any one to my knowledge, forms the principal point of my method, and in both operations it unites simplicity, facility, and the desired economy.*

Thus, if we treat the charcoal which retains the iodine with a solution of potassa, this element is readily given up, and iodide of potassium is immediately formed, mixed with a small proportion of iodate. The following is the reaction :—

$$6I+6KO=KO,\ IO^5+6KI\dagger.$$

In like manner, a solution of sulphate of iron, containing oxide of iron in suspension, being put in contact with the charcoal and agitated,‡ gives rise to the formation of iodide of iron, which is very soluble, and sesquioxide of iron, which is precipitated :

$$3FeO+I=FeI+Fe^2O^3.$$

The charcoal which has been freed from iodine by either liquid, after having been washed, may be used for absorbing more iodine, which may be again removed from it by the process described.

Having explained the general bases on which my method of extracting iodine is founded, I will notice its peculiarities and describe some results which I have obtained by putting my observations in practice.

I took a barrel of water containing iodine obtained from the spring of Castrocaro, in Tuscany, and I effected the decomposition of the iodides contained in it either by means of chlorine or with the aid of acids.

From my investigations, I am led to prefer a mixture of one part of sulphuric with two parts of nitric acid, because this liquid has not only the advantage of decomposing the iodides very well, but also because they may be added in excess without any considerable inconvenience. I should, however, give the preference to chlorine if we had a sure means of limiting its action to the decomposition of the iodides, so that the excess of chlorine should not react on the iodine set free ; but it is difficult to know this limit, especially in operating in the large way, which may occasion the loss of a large portion of the product.

The decomposition of the iodides being completed, I passed the water through a kind of filter containing a large quantity of calcined lamp-black. This filter had somewhat of the form of a displacement apparatus. This apparatus succeeded very well, because the water, having traversed several layers of charcoal, was completely deprived of iodine. I have remarked that when the apparatus is not arranged thus, the water must be retained several hours in contact with the charcoal for the precipitation of the iodine to be complete.

After having washed the charcoal, I put it in contact with hydrated oxide of iron, thoroughly agitating the mixture, which then resembled a sort of pap. I put this mixture into the displacement filter, and pour water on it several times, in order to remove all the iodide of iron which has been formed.

The liquid containing iodide of iron having been collected in a vessel and treated with sulphate of copper, iodide of copper is formed, which, collected and placed in a retort with oxide of manganese and sulphuric acid, disengages with the aid of heat, all the iodine it contains.

The charcoal which had been used in this operation was put into a vessel containing water and hydrochloric acid, in order to separate from it any remaining oxide of iron and, thus purified, it may serve for another operation.

Although the treatment of the iodised charcoal may give good results, I think, for several reasons, that the employment of hydrated oxide of iron should be preferred : in the first place, because with the latter agent there is formed an iodide of iron very soluble and very easily separated from the carbon, whilst caustic potassa gives rise to a sparingly soluble iodate, thus necessitating the employment of large quantities of water for its solution; secondly, because, from the iodide of iron we may obtain by Baup's method very good iodide of potassium or sodium, the former of which is in extensive demand for various purposes ; and in the third place, because the iodide of iron may be obtained directly by evaporating the liquid in a tubulated retort, by which a current of hydrogen gas is passed in, in

* If boiling water or alcohol remove from charcoal some compound which, by the addition of an acid or chlorine, colors starch, it must not therefore be concluded that the charcoal has formed with the iodine peculiar compounds, but that the charcoal was impure, and that in the precipitation of the iodine some compound has been formed which has become soluble in boiling water or alcohol.

† It must be borne in mind that the iodate of potassa is only sparingly soluble in water: consequently a large quantity of water is required for removing this compound entirely from the charcoal.

‡ The oxide of iron may be precipitated by caustic potassa, and there is no inconvenience in the liquid containing a little sulphate of potassa.

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order that it may not be mixed with subiodide of iron.

Iodide of iron, as is known, is very much employed in medicine, so that it is advantageous in a commercial point of view.

Finally, if we evaporate to dryness, in an iron receiver, the liquid containing the iodide of iron, and if the residue be put into a retort with peroxide of manganese and sulphuric acid, the iodine is extracted from it and condensed in a receiver. The method proposed and practised by Serullas may likewise be made use of, in order to extract the iodine from the salt of Warech, that is to say, precipitating the iodine by means of sulphate of copper. It is for this that we have recommended obtaining the oxide of iron in suspension in sulphate of iron, for it is known that on the addition of sulphate of copper to iodide of iron, we effect the complete precipitation of the iodide of copper.

These results have led me to hope that I have satisfied the wishes of the Academy, and as regards the application of the process in the large way, it appears to me to fulfil the required conditions.

I divide this process into three distinct operations:—

The apparatus is composed:—1. Of a large vat into which the water of the spring containing the ioduretted compounds and in which the iodides are decomposed, by means of the mixture of sulphuric and nitric acids.

2. Of a receiver placed beneath this vat having the form of a displacement filter, into which the calcined lamp-black destined for precipitating the iodine is placed. At the bottom of this filter is fixed a sponge to retain the charcoal in its place so that it may not be carried out in the filtration: under the sponge there is a tube for retarding the filtration if it becomes too rapid. The filter is furnished with a kind of hatch, by which the charcoal is let into the second displacement filter, after having been washed with pure water.

3. Of a second filter, in which the oxide of iron is mixed and agitated with the iodised charcoal, and afterwards treated with water to remove the iodide formed.

The lixiviation in the large way of the matter containing iodide of iron should be conducted with much attention; on one hand, we should endeavor to extract from it the greatest possible quantity of iodide of iron, and on the other, it is essential to use as little water as possible, in order not to have too large quantities to evaporate. It is true that it is difficult to make a complete extraction, and to arrive precisely at the necessary limits; but by operating with care it may be hoped that the losses will not be appreciable. On this subject, I may remark that the charcoal should be washed several times, and not merely once, in order to obtain liquids containing various proportions of iodide of iron, from which the charcoal is gradually freed. The charcoal, which is the residue of this treatment, is put into a wooden vat, containing water acidulated with hydrochloric acid, in order to remove from it the oxide of iron which it may contain.

OBSERVATIONS ON LIME, AND ON TWO NEW COMBINATIONS OF THIS BASE WITH THE SESQUIOXIDES OF IRON AND CHROMIUM.*

BY M. J. PELOUZE.

The first idea of the existence of these new compounds whose description forms the principal object of this note, was owing to chance. I examined an earthy ore of iron, containing a considerable proportion of lime; I had made a solution of it in hydrochloric acid, and had mixed it with caustic potassa; I obtained a yellowish white precipitate, presenting no peculiarity at first sight, but which became perfectly white after some hours, and then turned of an ochre red after longer exposure to contact with the air. This circumstance attracted my attention, and after some fruitless attempts to discover the cause of the phenomenon I have just described, I finally ascertained that it must be attributed to a true combination of lime and peroxide of iron, whose existence has hitherto escaped the notice of chemists. I am able to reproduce this combination at will by precipitating directly, by a solution of caustic potassa, certain atomic mixtures of a salt of lime and a salt of iron.

When we dissolve in water a quantity of perchloride of iron, representing 1 equivalent of peroxide of iron, and add to it 4 equivalents of chloride of calcium, an excess of potassa forms in this mixture a precipitate of a chamois color, which becomes perfectly white in a few hours, and is preserved indefinitely in this state, provided it be kept out of contact with the air. The precipitate formed in the inverse manner, that is to say by pouring into an excess of potassa the mixture of the salts of lime and iron, presents the same color and likewise becomes white after some time. This pre-

* *Comptes Rendus*, July 21, 1851.

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cipitate, washed with boiled water, and then with water containing sugar, gives up only potassa, and oxalate of ammonia forms only an imponderable cloud in the washing waters; but if the precipitate, instead of being formed as just described, is made in the presence of a larger proportion of the lime salt than 4 equivalents to 1 equivalent of the salt of iron, the solution of sugar removes from it very considerable quantities of lime. This circumstance is explained by the composition of the new double oxide: it is formed of 1 equivalent of peroxide of iron and 4 equivalents of lime.

The phenomena of coloration and decoloration which this precipitate presents is easily explained; a portion—very small it is true—of hydrated sesquioxide of iron is precipitated without combining with the lime: whence the chamois color of the double oxide, which color disappears completely in consequence of the ultimate and complete combination of the two bases. As regards the brick-red color which the compound acquires in contact with the air, it is due to the action of carbonic acid, which combines with the lime and liberates the oxide of iron; thus we find, after a sufficient exposure to the air, that the lime is entirely converted into carbonate.

The ferrite of lime (as I designate the combination of lime and peroxide of iron) is a light, amorphous powder, perfectly white, although it contains 42 per cent. of peroxide of iron; it is insoluble in water, whether pure or containing sugar; boiled with water containing carbonic acid or a soluble carbonate, it is decomposed and assumes a brick-red color: the oxide of iron becomes free and is mixed with the lime converted into carbonate. Ferrite of lime may be boiled with caustic potassa without undergoing any alteration, which is easily perceived, as it remains perfectly white. All the acids, even the weakest, decompose ferrite of lime, combining at once with both of its basic elements.

The composition of ferrite of lime may be demonstrated in several ways. By dissolving it in hydrochloric acid, we obtain a yellow solution, from which ammonia precipitates all the iron in the state of hydrate of sesquioxide which is calcined: the liquor, filtered and added to the washing waters, gives with oxalate of ammonia a precipitate of oxalate of lime, which is converted into sulphate. The analysis thus made of ferrite obtained with an excess of lime and washed, indicates constantly, for 1 equivalent of peroxide of iron 4 equivalents of lime. It is probable that the precipitate contains water of combination; but as it is impossible to dry it without partial decomposition, I have confined myself to determining the respective proportions of the two oxides of which it was formed.

I have besides proved that this double oxide, when well washed, does not contain potassa; on decomposing it completely by carbonic acid and afterwards treating with boiling water and evaporating to dryness, there was no residue of evaporation, and no precipitate was formed with a concentrated solution of bichloride of platinum.

On the other hand, when we precipitate by potassa 1 equivalent of perchloride of iron diluted with water, mixed with 4 equivalents of chloride of calcium, the precipitate becomes perfectly white in a few hours; whilst if we add to this solution only 3 equivalents, 3½ equivalents or 3¾ equivalents of chloride of calcium, the precipitate remains colored, even after having been abandoned to itself for several months. This last experiment would alone suffice for showing that the ferrite of lime, supposed anhydrous, has the formula—

$$Fe^2O^3, 4\,CaO$$

which corresponds to the following centesimal composition:—

	O=100	
Fe^2O^3	1000	41·66
4CaO	1400	58·34

Independently of its great instability, ferrite of lime is remarkable in this, that although containing nearly half its weight of peroxide of iron, its color is perfectly white.

I have already said that ferrite of lime, obtained by precipitating, by an alkaline solution, a mixture of 1 equivalent of perchloride of iron and 4 equivalents of chloride of calcium became white only some hours after its preparation. I will add that it may be obtained so in a few minutes by boiling the precipitate and the liquor with which it is mixed.

Finally, when the chloride of calcium exceeds 4 equivalents, the ferrite of lime is perfectly white when first prepared, but then it is mixed with an excess of lime.

LIME AND OXIDE OF CHROMIUM.

Chromite of Lime.

I have endeavored to replace oxide of iron in the combination already described by several other oxides of analogous composition, and I have succeeded as regards some of them, and particularly with the sesquioxide of chromium.

When an excess of caustic potassa is poured into a solution formed of 1 equivalent of chrome alum, and of 2, 3, 4, &c. equivalents of chloride of calcium, a green precipitate is produced, and the supernatant

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liquor is colorless. As the pure hydrate of sesquioxide of chromium is solubie in a cold solution of potassa, with which it forms a green liquor, the foregoing experiment led me to suspect the formation of a combination of lime and sesquioxide of chromium.

The precipitates containing, for 1 equivalent of sesquioxide of chromium, more than 2 equivalents of lime, yield their excess of lime to a solution of sugar, so that we arrive at a unique compound : Cr^2O^3, 2 CaO.

The same compound is produced in a still more simple manner by substituting ammonia for potassa ; but here the excess of lime, instead of being precipitated, remains in solution in the ammonia. The precipitate, after being well washed, treated with weak sulphuric acid, then diluted with alcohol, gives a white precipitate of sulphate of lime, whilst the liquor and the washing waters deposit, under the influence of the ammonia, all the sesquioxide of chromium which they contained.

Several analyses of the washed double oxide gave the formula :—

Cr^2O^3, 2 CaO,

which represents in hundredths :—

	O=100	per cent.
$Cr2O^3$	957	57·75
2CaO	700	42·25

The chromite of lime occurs under the form of a rather gelatinous green precipitate without perceptible taste, insoluble in pure water, ammonia and potassa ; much more slowly and difficultly decomposable than the ferrite of lime by free carbonic acid or the carbonates, and incapable of being dried without undergoing decomposition.

When it is heated in contact with the air it gradually changes into chlorate of lime ; the following equation explains this reaction :—

Cr^2O^3, $2CaO+O^3=2(Cr^2O^3, CaO)$.

The absorption of oxygen takes place at a temperature much below dull redness. I have several times proved this fact by heating the chromate of lime. This transformation is made evident by heating this compound with hydrochloric acid, with which it disengages chlorine, as do the chromates.

Chromite of lime, calcined in an open tube, by the heat of a spirit-lamp, also furnishes chromate of lime, but the greater part of the sesquioxide of chromium is separated under the form of a green powder of crystalline appearance.

The formation of this combination of oxide of chromium and lime in the circumstances just indicated, shows clearly the inaccuracy of the result arrived at in precipitating in an analysis the oxide of chromium by means of an alkali, either with or without the aid of heat, when a salt of lime is present.

I have said that the compound of sesquioxide of chromium and lime was insoluble in a cold solution of potassa ; but, when the proportion of lime is relative to that of the sesquioxide of chromium taken as unity less than 2 equivalents, potassa redissolves not only the oxide of chromium, but the lime itself ; thus, we obtain with potassa a precipitate soluble in an excess of that alkali with two solutions formed, one of 20 parts of chrome alum and 1 part of marble dissolved in hydrochloric acid, and the other of 10 parts of chrome alum and 1 part of marble.

The complete precipitation of a mixture of chrome alum and of chloride of calcium, in even very considerable excess, presents a very peculiar circumstance, which a very attentive examination enables us to explain very clearly : the supernatant liquor of the precipitate contains only imponderable traces of lime ; this is because the salts of lime, in presence of an excess of potassa, deposit the whole of their lime, and this lime, in the foregoing experiment, is simply mixed with the chromite of lime.

This insolubility of lime in an alkaline liquor is sufficiently remarkable for the attention of chemists to be called to it.

When one part of caustic potassa or soda is boiled with 100 parts of water, and an excess, however great, for example, 10 parts of hydrate of lime, the liquor filtered, either cold or hot, does not contain more than one-fifty thousandth of lime. Although the balance cannot possibly appreciate such minute traces of lime, it is no less certain that the foregoing numbers are, if anything, too high, for oxalate of ammonia introduced into a solution containing only 1 part of lime in 50,000 parts of water, forms in it a much more considerable precipitate than in the foregoing case.

From this experiment it results that potassa and soda, either in the solid state or in even very dilute solution, can never be found mixed with lime, even when these alkalis have been prepared with an excess, however considerable, of lime, and even in the presence of water containing the largest quantity of lime salts.

As I had expected, after having proved the facts above mentioned, a solution of potassa or soda, completely deprived of carbonic acid, produces an abundant precipitate in lime water, even when very dilute. This precipitate, which is similar in appearance to that produced by carbonic acid, appears to be nothing but lime itself.

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Its very simple formation is due to its insolubility in an alkaline liquor.

As a consequence of this insolubility, it follows that, when lime water is poured into the solution which results from the action of slaked lime on the carbonates of potassa or soda, with the view of ascertaining the degree of causticity of these alkalis, there must be and indeed there always is formed a white precipitate; so that the extreme term of this preparation of caustic potassa and soda cannot be indicated, as has been incorrectly asserted, by the absence of precipitate, and that to prove it other reactions must be resorted to.

I investigated whether ammonia partook with potassa and soda the property of rendering lime insoluble; as ammonia is often employed in analytical researches, and as it presents certain inconveniences when it is carbonated, it was useful to ascertain whether slaked lime removed from it carbonic acid without itself entering into solution.

When liquid ammonia mixed with carbonate of ammonia is agitated with hydrate of lime, the carbonic acid is entirely removed in the state of carbonate of lime, but a portion of the lime remains in solution in the ammonia.

I mention this reaction because there are cases, in analysis, in which the carbonic acid must be separated from the ammonia, whilst a small quantity of lime is immaterial to the result sought for.

Lime and alumina.

Lime combines with alumina in almost the same conditions as the oxides of iron and chromium.

When 2 parts of alum are dissolved in water and an aqueous solution of 10 parts of alcohate of potassa added, chloride of calcium forms in the liquid a gelatinous and white precipitate of aluminate of lime, which retains the whole of the alumina.

Whatever may be the degree of alkalinity of the liquor, no alumina is found in it. This appears only when the mixture is submitted to the action of heat.

LIME AND PHOSPHORIC ACID.

The combination of lime and phosphoric acid is formed when chloride of calcium is poured into a mixture of phosphate of soda and caustic potassa; the liquor does not retain the smallest trace of phosphoric acid.

LIME AND SILICA.

Lime combines with silica, with which it forms an insoluble white precipitate, which is obtained by pouring chloride of calcium into an excess of caustic potassa mixed with silicate of potassa. The solution does not retain silica, for, when it is saturated with an acid and evaporated to dryness, the residue is entirely soluble in water.

LIME, ALUMINA AND SILICA.

When a mixture of alum and alkaline silicate in an excess of caustic potassa is treated by a solution of chloride of calcium, an abundant precipitate is formed, which contains silica, alumina and lime; the supernatant liquor of this deposit, supersaturated with nitric acid, produces no precipitate with ammonia, whence it follows that it does not contain alumina. Evaporated to dryness with an excess of acid, and dried at 392° F. the residue entirely redissolved in acidulated water, which demonstrates also that the same liquor did not contain silicic acid.

There is precipitated, then, in this experiment, a substance composed of the same elements as lime felspar.

As the formation of lime felspar by the humid way has never been examined, and as it may present a high degree of interest in a geological point of view, I propose to follow up the examination of this combination and investigate whether, as I at present suppose, it is really identical with felspar.

CHEMICAL RESEARCHES ON THE SOFT ROE OF THE CARP.*

BY M. GOBLEY.

(Concluded from page 494.)

LECITHINE.

From what we have said of the properties of the fatty matter of the soft roe, it cannot be doubted that the phosphuretted substance which it contains is identical with that which I found in the yolk of the fowl's egg and in the eggs of the carp, since it gives the same products: only in the soft roe it is accompanied by a larger proportion of cholesterine and cerebrine which disguise its properties and shield it from the action of chemical agents. In the soft roe, as in fowls' eggs and the eggs of the carp, lecithine evidently constitutes a neutral body, for it is not combined with any base, and the roe does not exert any influence on litmus paper.

All that I have said of the lecithine of the eggs of the fowl and of the eggs of the carp may be repeated as regards that of the

* *Journal de Pharmacie et de Chimie*, June 1851.

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soft roe. The products of the decomposition are, likewise, oleïc, margaric, and phosphoglyceric acids.

Oleïc and Margaric acids.—It is easy to procure these acids either by the processes which I have pointed out for obtaining them from the eggs of the carp, or by decomposing, by prolonged contact at the ordinary temperature, the fatty matter of the soft roe by means of alcohol containing potassa. The filtered liquid is decomposed with the aid of heat by acetic acid and left to spontaneous evaporation. The fatty acids are afterwards treated as I have pointed out in my first memoir. The crystallisation, properties and composition of the solid acid are those of margaric acid.

0·281gr. of this substance furnished 0·776gr. of carbonic acid and 0·319gr. of water, which gives in hundredths:—

Carbon	75·444
Hydrogen	12·455
Oxygen	12·101
	100·000

The liquid fat had a yellowish tint and a thickish consistance: besides much oleïc acid and a small quantity of margaric acid, it contained a certain quantity of cerebrine. To separate the latter, I submitted the product which I had obtained to long boiling in water acidulated with hydrochloric acid, and the liquid filtered and washed with distilled water was exposed gradually to a lower and lower temperature, until it reached 16° F. Thus prepared, it possessed a brown color, and its properties showed it to be oleïc acid.

Phospho-glyceric Acid.—Like the fatty acids, it may be obtained by several processes. That which I prefer consists in decomposing the fatty matter of the soft roe with alcohol acidulated with hydrochloric acid: the mixture is diluted with distilled water, and the fatty acids are separated by means of a moistened paper. The saturation of the liquor is commenced with carbonate of lime and concluded with hydrate of lime: it is filtered and evaporated and rectified alcohol is added. This addition determines the precipitation of phosphoglycerate of lime, which carries with it a small quantity of chloride of calcium. The precipitate is dissolved in distilled water, and after filtration it is again precipitated with alcohol. This operation is repeated a second, a third, and even a fourth time. The object of these operations is to separate as much as possible of the chloride of calcium.

The phosphoglycerate of lime is afterwards redissolved in a very large quantity of distilled water, and a slight excess of acetate of lead is added. Phosphoglycerate of lead is precipitated, which is washed in distilled water and decomposed with hydrosulphuric acid; the phosphoglyceric acid is then converted into a salt of lime, which is obtained as we have said in speaking of the eggs of the carp.

0·380gr. of this salt dried at 248° F. left, by decomposition with the aid of heat and nitric acid, 0·229 of phosphate of lime, or 60·26 per cent.

Combustion by means of chromate of lead gave:—0·420gr. of salt of lime, which, dried at 248° F., furnished 0·262gr. of carbonic acid and 0·132gr. of water. We have, therefore,

Phosphate of lime	60·26
Carbon	17·01
Hydrogen	3·49
Oxygen	19·24
	100·00

The properties and composition of the phosphuretted acid of the soft roe leave us in no doubt that it is phosphoglyceric acid identical with that furnished by fowls' eggs and the eggs of the carp.

CEREBRINE.

When the fatty matter of the eggs of the carp is treated with alcohol acidulated with hydrochloric or sulphuric acid, we obtain, as I have said, a fatty body which soon deposits a white substance, of soft consistance, which I have designated by the name of cerebrine. The fatty substance of the soft roe acts in the same manner in the presence of these reagents.

Cerebrine exists in the soft roe, as in the eggs of the carp, intimately united with lecithine, and I have not been able to isolate it without decomposing the latter. To obtain it, I have had recourse to the process which I had employed for procuring that of the fowls' eggs. Thus prepared, it possesses all the properties and the composition of the latter.

0·380gr. of cerebrine dried at 428° F., furnished 0·935gr. of carbonic acid and 0·368 of water.

0·392gr. of the same substances gave 7 cubic centimeters of nitrogen at 57° F. and 0·764mm, the humid gas.

0·424gr. of cerebrine, burned by means of nitrate and carbonate of potassa, furnished 0·13 of phosphate of baryta, which gives 0·42 per cent. of phosphorus.

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We have then in hundredths:—

Carbon	67·01
Hydrogen	10·75
Nitrogen	2·10
Phosphorus	0·42
Oxygen	19·72
	100·00

There is, therefore, no doubt that the cerebrine of the soft roe is identical with that of the yolk of the fowls' eggs and the eggs of the carp.

CHOLESTERINE.

In submitting the fatty matter to the action of solvents and of chemical agents, I ascertained from my first experiments that it contains a crystalline substance. This appeared to me always under the form of very small lamellæ, but that was owing to its being modified in its crystallisation by lecithine, cerebrine, oleïne, margarine, or else by oleïc and margaric acids, for subsequent researches have demonstrated to me that this body is nothing but cholesterine.

To obtain it, the fatty substance of the soft roe is decomposed by prolonged contact, at the ordinary temperature, with alcohol containing potassa. There remains, as we have seen, a white deposit which contains a large proportion of cholesterine, which may be separated by means of boiling alcohol.

It is purified by treating it several times with boiling alcohol containing potassa, and taking care each time to wash with alcohol the lamellæ of cholesterine received on the filter.

The cholesterine obtained by this means is not crystallised in scales like that of the yolk of the fowl's egg and the eggs of the carp: it rather affects the form of ribbon. I have long sought to account for this difference in the crystallisation, and I have at length ascertained that it is due to the presence of a certain quantity of cerebrine. This substance is easily separated by means of chlorine which does not dissolve it: the ethereal liquid, decanted, gives cholesterine which is redissolved in boiling alcohol.

Thus prepared, it is perfectly similar to that of the eggs of the fowl and the carp. It affects the same crystalline form and possesses the same properties. Its composition is that of the cholesterine of biliary calculi, of the eggs of the fowl and the carp.

0·402 of this substance fused, furnish 1·254 of carbonic acid and 0·426 of water; which gives in hundredths:—

Carbon	85·075
Hydrogen	11·691
Oxygen	3·234
	100·000

100 parts of soft roe contain about 0·160 of cholesterine.

OLEINE AND MARGARINE.

When we saponify, by means of potassa and in the ordinary way, the oil which is obtained by decomposing the fatty matter of the soft roe with acidulated alcohol, it is easy to ascertain that it is formed of oleïne and margarine, for the products of the saponification are oleïc and margaric acids. With this fatty body as with the oil of the egg and the fatty matter of the eggs of the carp it is necessary to guard against cholesterine, care must be taken only to saponify an oil which has been freed from this substance by means of boiling alcohol.

SALTS OF THE SOFT ROE.

The quantity of salt contained in the soft roe of the carp is very considerable. When, after having divided it, it is boiled in water, a slightly acid liquid is obtained which becomes more so when, reduced to a small volume, alcohol is added to it. I submitted this liquor to the same proofs as that which the eggs of the carp furnished me in the same circumstances, and it presented the same properties. The soft roe does not exert, as I have said, any action on vegetable colors: it is difficult therefore to imagine that the acid preexists in it, and it should rather be regarded as a product of decomposition. It is not formed by an absorption of oxygen, for it is likewise developed when we operate out of contact with the air.

The soft roe contains a certain quantity of extract of meat, about 0·360 per cent.

To extract the salts of the soft roe, a certain quantity of it is taken, which is steeped in several times its weight of water, after being divided, and boiled for a few minutes: it is thrown on a filter, the liquid replaced by distilled water, and the residue immersed in alcohol, is again put on the filter. The liquors, evaporated and treated with alcohol, deposited a soft, whitish matter, formed of earthy phosphates and animal matter.

The alcoholic liquid contained extract of meat and the soluble salts; after evaporation, the residue, dried at 248° F., weighed 0·679gr. for 100 grammes of soft roe; then, by destroying the organic matter by heat, I proved that there remained 0·319gr. of soluble salts.

The 100 grammes of soft roe which had served for this operation, and to which was added the deposit formed by alcohol, were dried; the residue freed from fatty matter by means of ether, weighed 24 grammes. Besides the phosphates of lime and magnesia, this substance contained a certain

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quantity of soluble salts which had not been dissolved in the first operation. To determine the proportion of earthy phosphates and of soluble salts which it contained, I took 4 grammes of it which I put in contact with distilled water; after filtration and evaporation, I obtained 0·0335gr. of soluble salts; which for the 24 grammes gave 0·201gr. The residue, dried and burned with the aid of nitrate of ammonia, left 0·087 of phosphates of lime and magnesia, or 0·522gr. for the 24 grammes.

I ascertained that the 0·520gr. of soluble salts were formed, as a mean, of

Chlorides of sodium and potassium	0·380
Phosphate of potassa	0·100
Sulphate of soda	0·040
	0·520

The liquor which results from the action of boiling water on the soft roe of the carp contains hydrochlorate of ammonia in the proportion of about 0·048 per cent.

ODOROUS PRINCIPLE.

I repeated on the soft roe the experiments which I made with the eggs of the carp, and the results were the same. Thus, in soft roe as in the eggs of the carp, the odor is due to a volatile principle which does not appear to be of acid nature.

CONCLUSIONS.

I think I may conclude from my experiment:—

1. That the soft roe contains the same elements as the yolk of the fowl's egg and the eggs of the carp, but in different proportions.

2. That it presents so great an analogy of properties and composition with the substance of the brain that one might be led to believe that it is destined to form the nervous system of the young animal. It will be remembered that MM. Dumas and Prevost have considered the spermatozoïd or male generative element as the germ of the cerebro-spinal system, the first that makes its appearance in the embryo.

3. That the soft roe contains three-fourths of its weight of water.

4. That it contains an albuminous matter, and likewise a peculiar membranous or glandular body which is divided in water without our being able to separate it by filtration.

5. That the fatty matter is formed of lecithine, cerebrine, cholesterine, oleïne and margarine; that these substances present the properties and composition of those which I found in the yolk of the fowl's egg and in the eggs of the carp; that oleïne and margarine exist in it in a very small quantity, as in these last named substances.

6. That the soft roe is neutral; that by boiling it with water, in contact with the air or in an atmosphere of carbonic acid gas, an acid liquid is obtained which becomes more acid by the addition of alcohol; that this property is due to lactic acid or to an acid which greatly resembles it in properties.

7. That it contains the salts which are found in the eggs of the carp, in yolk of egg, and in almost all animal organic substances: chlorides of sodium and potassium, hydrochlorate of ammonia, sulphate of potassa, phosphates of potassa, lime and magnesia.

8. That it contains extract of meat and an odorous principle, which does not appear to be a volatile fatty acid.

9. That the soft roe of the herring presents the same properties and composition as that of the carp.

10. That, on the average, the composition of the soft roe of the carp is, in 100 parts:—

Water	74·805
Albumen, glandular or membranous matter	20·242
Lecithine	1·013
Cerebrine	0·210
Cholesterine	0·160
Oleïne and margarine	2·120
Hydrochlorate of ammonia	0·048
Chlorides of sodium and potassium	0·380
Sulphate and phosphate of potassa	0·140
Phosphates of lime and magnesia	0·522
Extract of meat	0·360
	100·000

ON THE DIFFUSION OF LIQUIDS.*

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(Concluded from page 487.)

30. *Chloride of Potassium.*—Time of diffusion 5·71 days. The salt diffused was treated with nitrate of silver, and the chloride of silver weighed.

Diffusion in 5·71 days at 62°; two cells.

* *Quarterly Journal of the Chemical Society.*

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	Grs.	Ratio.
From 1 per cent solution.....	6·69	1·005
From 2 per cent solution....	13·32	2
From 4 per cent solution.....	25·94	3.895
From 8 per cent solution.....	53·64	8·054

The ratios are in remarkably close accordance with the proportions of salt diffused.

The times 5.71 and seven days chosen for the chlorides of potassium and sodium, it will be observed, are as the square roots of 2 and 3. A certain deviation from this ratio of the times of equal diffusion, appears on comparing the experimental results obtained at present for these salts.

Diffusion of chloride of potassium in 5·71 days at 62 °, and of chloride of sodium in 7 days at 63°.4.

Chloride of potassium, 1 per cent.....	6.69	100
Chloride of sodium, 1 per cent.....	6·32	94·47
Chloride of potassium, 2 per cent.....	13·32	100
Chloride of sodium, 2 per cent.....	12·37	92·86
Chloride of potassium, 4 per cent.....	25·94	100
Chloride of sodium, 4 per cent.....	24·96	96.23
Chloride of potassium, 8 per cent.....	53·64	100
Chloride of sodium, 8 per cent.....	48·44	90.30

The difference would be about 1 per cent. greater if the diffusion of both salts were reduced to the same temperature. The chloride of potassium deviates of course from the nitrate of soda in a similar manner. But chloride of potassium corresponds more closely with nitrate of silver than with chloride of sodium and nitrate of soda, at the temperature of the experiments.

Diffusion of chloride of potassium for 5·71 days at 62°, and of nitrate of silver for 7 days at 63°.4.

Chloride of potassium, 2 per cent.....	13·32	100
Nitrate of silver, 2 per cent.	13·61	102·18
Chloride of potassium, 4 per cent.....	25·94	100
Nitrate of silver, 4 per cent.	26·34	101.54
Chloride of potassium, 8 per cent.....	53·64	100
Nitrate of silver, 8 per cent.	51·88	96·71

The coincidence in rate would appear even closer in the 2 and 4 per cent. solutions, if the diffusion of the nitrate of silver was diminished about 1 per cent., on account of its higher temperature. It might thus be supposed that the nitrate of silver followed the sodium rate more accurately than the nitrate of soda and chloride of sodium themselves do.

A series of observations were made upon the diffusion of the 1 per cent. solution of chloride of potassium at a nearly constant temperature of 56°, but for different times, varying from five days to eight days, and eighteen hours, to discover the progression, which proved to be pretty similar to that of the 2 per cent. solution of hydrochloric acid. Six cells were diffused for each period, of which the mean result is given: the times advance by ten hours.

Diffusion of 1 per cent. solution ; two cells.

Time.	Temperature.	Diffusion in 2 cells.	Differences.
5 days	55°·71	5.89	
5 days 10 hours	55 ·90	6·25	0·36
5 days 20 hours	55 ·79	6·55	0·30
6 days 6 hours	55 ·79	6.71	0.16
6 days 16 hours	55 ·90	6·95	0.24
7 days 2 hours	55 ·9	7·48	0.53
7 days 12 hours	55 ·9	7·58	0·10
7 days 22 hours	56 ·03	8·08	0.50
8 days 8 hours	56 ·28	8·34	0·26
8 days 18 hours	56 ·15	8·60	0·26

When the quantities of chloride of potassium are placed beside the same quantities of hydrochloric acid in the former table, it is found that the times of diffusion of the salt and acid exhibit an approximately constant ratio. The squares of these times of equal diffusion are as 1 to 2·04 for the shortest period of the chloride of potassium, and as 1 to 2·10 for the longest period but one. The variation in the differences towards the middle of the table is too great to be explained, except I fear by some error of observation, although no ordinary precaution was neglected in the execution of this laborious series of experiments.

31. *Iodides and bromides of potassium and Sodium.—Iodide of potassium.*—Time of diffusion, 5·716 days. The diffusate was estimated by means of nitrate of silver.

(1). Iodide of potassium, 1·977 per cent.; density 1·0145. Diffused at 53°·5, in eight cells, 11·415, 11·506, 10·942 and 11·062grs.; mean 11·24 for two cells, and 11·36 for 2 per cent.

Comparing this salt with the isomorphous chloride of potassium, we have :—

Diffusion of 2 per cent. solutions in 5·716 days.

Chloride of potassium at 55°	11·48	100
Iodide of potassium at 53°·5	11·36	99.65

The diffusion of the iodide would slightly exceed that of the chloride, instead of falling

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below it as in the table, if the temperatures were made equal.

(2). Again, iodide of potassium 1·971 per cent.; observed density 1·01486. Diffused at 59°·8, in eight cells, and the mean diffusate of the whole cells determined, it gave 12·33grs. of iodide of potassium for two cells; or 12·51grs. for 2 per cent. solution.

Bromide of Potassium.—Time of diffusion and mode of estimating diffusate as above. The solution contained 1·975 per cent. of salt, and had a density of 1·014850. Diffused at 59°·8, in eight cells, it gave a mean diffusate of 12·30grs. for two cells; or 12·46grs. for 2 per cent.

For comparison, a solution of *chloride of potassium*, containing exactly 2 per cent. of salt and having the density 1·0133, was diffused in the same circumstances of time and temperature as the two preceding salts. The mean diffusate of eight cells was 12·24 grs. for two cells.

Hence the following result of the diffusion of three isomorphous salts:—

Diffusion of 2 per cent. solutions in 5·716 days, at 59°·8.

	Grs.	Ratio.
Chloride of potassium....	12·24	100
Bromide of potassium....	12·46	101·80
Iodide of potassium.....	12·51	102·21
Mean.....	12·40	

Iodide of sodium.—Time of diffusion seven days, temperature 59°·8. A solution of 2·011 per cent. and destiny 1·01618, diffused in eight cells, gave a mean diffusate of 12·24grs. for two cells; that is, 12·18grs. for 2 per cent solution.

Bromide of sodium.—Time of diffusion and temperature as above. A solution of 2·146 per cent., of density 1·01726, diffused in eight cells, gave a mean diffusate of 11·80grs.; that is, 11·93grs. for 2 per cent.

A comparative experiment was made with a solution of the *chloride of sodium*, containing 1·917 per cent. of salt and of density 1·01376, in eight cells, at 60°. The diffusates for four pairs of cells were 11·65, 11·75, 11·63 and 11·47grs.; mean 11·63grs., which gives by proportion 12·14grs. for a 2 per cent. solution. As the present salt differs only 0°·2 Fahr. in diffusion-temperature from the two present salts, which is inadequate to produce an assignable difference of diffusion, the three salts may be supposed to be diffused at the same temperature, without sensible error.

Diffusion of 2 per cent. solutions for seven days.

	Grs.	Ratio.
Chloride of sodium at 60°..	12·14	100
Bromide of sodium at 59°·8	11·93	98.27
Iodide of potassium at 59°·8	12·18	100.33
Mean.....	12·08	

In both these isomorphous groups of salts of potassium and sodium, there is certainly a near approach to equality of diffusion. The times for the salts of the two bases being in the empirical proportion of the square roots of 2 and 3, the mean diffusates also approach pretty closely; namely, 12·40grs. for the salts of potassium and 12 08grs. for the salts of sodium, which are as 100 to 97·42. Here the members of each group are certainly very similar to each other in density and probably other physical properties, which is not the case with the equidiffusive group containing the hydrogen acids of the same salt-radicals.

32. *Chloride of ammonium.*—Time of diffusion 5·716 days. The salt diffused was estimated by means of nitrate of silver.

Solution 0·088 per cent.; density 1.0036. Diffused at 53°, in eight cells, 6·09, 6·07, 5·67, 5·87; mean 5·92grs., and 5·99 for 1 per cent. in two cells. This is somewhat more than 5·68, one-half of the diffusate of the 2 per cent. solution of iodide of potassium, at nearly the same temperature. The diffusion, however, of the small proportions of salts of ammonium, such as the 1 per cent. solution, is apt to be given in excess, from their low density.

33. *Dichloride of copper.*—Time of diffusion seven days, or that of chloride of sodium. The salt diffused was obtained by evaporation to dryness, in an air-bath, after treating the liquid with an access of chlorine, in the form of chloride, from which the dichloride was calculated.

It was an object of interest to discover whether the dichloride of copper (Cu_2Cl), which would be isomorphous with the chloride of sodium, may separate from the protochloride of copper and other magnesian salts, and assume the high diffusibility of the salts of alkaline metals. But the salt in question is entirely insoluble in water. A solution, however, was obtained by dissolving an equivalent quantity of the red suboxide of copper recently precipitated, in hydro-chloric acid, of density 1·033, so as to give one grain of dichloride in every hundred water-grain measures of the solution. This acid solution did not precipitate by dilution with water. The salt was diffused into pure water at a mean temperature of 53°·2.

1. Dichloride of copper diffused 6·66,

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6·57, 7·01 and 6·48grs.; mean 6·68grs. in two cells. Chloride of sodium at 53°·4, nearly the same temperature, 5·90grs. in the same time. Reducing the result to the temperature of 51° by approximate correction, we should have 6·48grs. of dichloride of copper for that temperature, at which chloride of calcium gave 6·51grs. in 11·43 days, and protochloride of copper (Cu Cl) 6·06grs. at nearly the same temperature, also in 11·43 days.

So far as we can judge from an experiment at a single temperature, it would appear that the diffusion of dichloride of copper is more rapid than that of the chloride (Cu Cl), in a proportion which supposes the former compound to possess half the "solution-density" of the latter, the times of equal diffusion 7 and 11·43 days, being when squared as 1 to 2.

With the view of discovering whether the large proportion of hydrochloric acid, amounting to 7 per cent., present in the preceding solution of dichloride of copper, modified the solution of the salt, a portion of the same acid solution was treated with chlorine-gas, to convert the copper-salt into chloride, and diffused into water, after the excess of chlorine was removed by agitation of the solution with air. The proportion of salt present was thus increased in weight from 1 to 1·36 per cent. The time of diffusion was 11·43 days, and the temperature 53°.

2. Chloride of copper diffused from a 1·36 per cent. solution of the salt in hydrochloric acid, 5·83, 5·66, and 5·30grs. in two cells; mean 5·60.

The corresponding diffusion from a 1 per cent. solution may be supposed to be less than 5·0grs., in the proportion of 1·36 to 1, without any great error. The results thus become chloride of copper diffused, 3·98, 3·85 and 3·58grs.; mean 3·80grs. in two cells.

It hence appears that the diffusion of chloride of copper is much diminished by the presence of a great excess of hydrochloric acid in the same solution. Different causes suggest themselves for this result, such as the possibility of a combination existing of chloride of copper with chloride of hydrogen, in the acid solution; or the influence which must be admitted of the more soluble substance, in a mixture of two similar substances, in repressing the diffusion of the less soluble. The present result, however, is entirely opposed to the idea that the high diffusibility of the dichloride of copper, observed before is due to the hydrochloride acid present.

3. The diffusion of chloride of sodium also appears to be repressed by contact with a large excess of hydrochloric acid. One per cent. of chloride of sodium raised the density of dilute hydrochloric acid from 1·035 to 1·0408. Diffused into pure water for seven days at 52°·9, in eight cells, the diffusates of chloride of sodium were 3·80, 3·87, 4·00 and 3·86grs.; mean 3·88 for two cells. The diffusion of chloride of sodium is thus reduced in a corresponding measure with that of chloride of copper by association with seven times its weight of hydrochloric acid.

These results are interesting in a very different point of view. I have always watched for the appearance of some absorbent or imbibing power on the part of the acids, more analogous to an endosmotic attraction for water, as usually conceived. If such an attraction existed, it would complicate the phenomena of diffusion, for the volume of water absorbed by the acid would displace and project a portion of the latter into the reservoir, the phial not being extensible. The high diffusibility of hydrochloric and nitric acids would be thus explained. By such a mechanical displacement, the chloride of sodium would be thrown out in the preceding experiment, as well as the hydrochloric acid, which is not the case.

4. Even in hydrochloric acid, of density 1·124 (25 per cent.), the diffusion of 1 per cent. of chloride of sodium for seven days, at 56°·6, was found to amount to 4·7grs. only in two cells, and is less than from a solution in pure water.

5. In comparing the influence of nitric acid with that of hydrochloric acid upon the diffusion of chloride of sodium, it was found that in a 7 per cent. solution of nitric acid, the chloride of sodium (1 per cent.) was entirely decomposed in the diffusive process, at 56°·6, and gave hydrochloric acid in the full diffusive equivalent of that acid, together with nitrate of soda.

34. *Bicarbonate of potassa.*—Time of diffusion 8·083 days, or double that of hydrate of potassa. The water of the jars was partially charged with carbonic acid gas, to prevent the decomposition of this and the other bicarbonates in the act of diffusion. The whole diffusates of each proportion were mixed together, and the quantity of bicarbonate of potassa diffused for two cells, converted into the chloride of potassium, evaporated to dryness and weighed.

Diffusion in 8·08 days at 68°·2; two cells.

	Grs.	Ratio.
From 1 per cent. solution..	7·23	1·029
From 2 per cent. solution..	14·05	2
From 4 per cent. solution..	26·72	3·806
From 8 per cent. solution..	52·01	7·408

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35. *Bicarbonate of Ammonia.*—Time of diffusion 8·083 days. The whole diffusates of each proportion were mixed together, and the quantity of bicarbonate of ammonia, diffused for two cells, determined by an alkalimetrical experiment, which was always repeated twice.

Diffusion in 8·08 days at 68°·2; two cells.

	Grs.	Ratio.
From 1 per cent. solution..	6·91	1·013
From 2 per cent. solution..	13·65	2
From 4 per cent. solution..	27·00	3·959
From 8 per cent. solution..	50·10	7·346

The amount and progression of the diffusion of this salt correspond well, for all the proportions diffused, with the preceding isomorphous bicarbonate of potassa.

36. *Bicarbonate of soda.*—Time of diffusion 9·875 days. The whole diffusates of each proportion were mixed together, and the quantity of bicarbonate of soda, diffused for two cells, converted into chloride of sodium, evaporated to dryness and weighed.

Diffusion in 9·87 days at 68°·1; two cells.

	Grs.	Ratio.
From 1 per cent. solution..	7·31	1·059
From 2 per cent. solution..	13·81	2
From 4 per cent. solution..	26·70	3·869
From 8 per cent. solution..	52·38	7·590

A remarkable approach to equality in the diffusion of the bicarbonates of potassa and soda, in the times chosen, is observed equally in all the proportions of salt from 1 to 8 per cent.

The results for the three bicarbonates may be stated as follow, the diffusate of the 2 per cent. solution of bicarbonate of potassa, being made equal to 200, as a standard of comparison.

Diffusion of bicarbonates of potassa and ammonia in 8·08 days, at 68°·2, and of bicarbonate of soda in 9·875 days, at 68°·1:

	Bicarbonate of potassa.	Bicarbonate of ammonia.	Bicarbonate of soda.
From 1 per cent. solution.	102·9	98·3	101·0
From 2 per cent. solution.	200·0	194·3	196·4
From 4 per cent. solution.	385·6	384·3	380·0
From 8 per cent. solution.	740·8	712·6	748·3

Or, making the diffusate from each portion of the bicarbonate of potassa equal to 100:

	Bicarbonate of potassa.	Bicarbonate of ammonia.	Bicarbonate of soda.
From 1 per cent. solution.	100	95·53	101·07
From 2 per cent. solution.	100	97·15	98·20
From 4 per cent. solution.	100	100·97	98·54
From 8 per cent. solution.	100	96·19	101·03

The bicarbonate of ammonia is slightly lower in general than the bicarbonate of potassa, possibly from a small loss of the former salt by evaporation in the different operations. The times chosen for these two bicarbonates is to that of the bicarbonate of soda, as the square root of 2 to the square root of 3, and the remarkable agreement observed in the diffusion of these salts gives support, therefore, to that relation. In alluding to this relation, however, it is proper to add that the carbonates of potassa and soda deviate from it in a sensible degree, and the hydrates of potassa and soda very considerably. If the relation, therefore, has a real foundation, it must be marked in the salts last named by differences existing between them in certain properties, the discovery and investigation of which is of the last importance for the theory of liquid diffusion.

37. *Hydrochlorate of morphine.*—Time of diffusion 11·43 days. The crystallised salt was assumed to be of the composition $C^{34}H^{18}NO^6.HCl+6HO$, with the equivalent 374·5 The quantity diffused was determined from the chlorine, which was precipitated as chloride of silver in an acid solution. Hydrochlorate of morphine, 1·88 per cent. of the salt supposed anhydrous, diffused at 64°·1, in six cells, 11·03, 10·72, 11·01; mean 10·92grs. of the anhydrous salt for two cells. Calculated for 2 per cent., 11·60grs. at 64°·1 for two cells.

38. *Hydrochlorate of strychnine.*—Time of diffusion 11·43 days. The crystallised salt was assumed to be of the composition $C^{42}H^{22}N^2.O^4.HCl+3HO$, with the equivalent 397·5. Hydrochlorate of strychnine, 2 per cent., density 1·0065, diffused at 64°·1, in six cells, 11·54, 11·62, 11·31; mean 11·49grs. for two cells. The quantities refer to anhydrous salt, and were estimated from the chlorine, as with hydrochlorate of morphine.

These two analogous salts appear to approach very closely in diffusibility.

Diffusion from 2 per cent. solutions at 64°·1; two cells.

Hydrochlorate of morphine	11·60	100
Hydrochlorate of strychnine	11·49	99·05

For a similar period of 11·43 days, but at a lower temperature, 58°·4, the 1 per cent. solution of hydrochlorate of morphine gave a mean result of 5·49grs. from two cells and the hydrochlorate of strychnine 5·77 grs. from two cells. But the weights of chloride of silver from which these numbers are deduced were too small to admit of much precision.

The diffusion of these salts of organic

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bases in 11·43 days, is exceeded by the diffusion of chloride of ammonium or potassium in 5·71 days, or half the former time. The vegeto-alkalies appear thus to be divided from ammonia and potassa.

The new observations of the present paper are favourable to the existence of a relation amounting to close similarity or equality in diffusibility between certain classes of substances.

The chlorides and nitrates of the same metal generally exhibit this correspondence, as in the chloride of calcium and nitrate of lime, the chloride of sodium and nitrate of soda, as also in hydrochloric and nitric acids.

Isomorphous salts exhibit the same relation, as has been observed in the chlorides, bromides and iodides of potassium, sodium and hydrogen, in various salts of baryta, strontia and lead, in numerous magnesian salts, in the salts of silver, soda, and probably those of suboxide of copper, and in several additional salts of potassa and ammonia.

Corresponding salts of two of the vegeto-alkalies are also found to be equidiffusive.

Before discussing the relations between the different groups of equidiffusive substances which are thus formed, it will be necessary to examine their diffusion at widely different temperatures, a subject attended with considerable difficulty.

ON A NEW COMBINATION OF MERCURY.*

BY SIGNORI SOBRERO AND SELMI.

When we make a solution of bichloride of mercury in alcohol at 40 degrees, and precipitate the oxide by an alcoholic solution of potassa, so as to render the liquid powerfully alkaline, a yellow precipitate is obtained which is not oxide of mercury, but a combination of mercury with the three elements, carbon, hydrogen and oxygen. This precipitate is amorphous and insoluble in water and alcohol: it may be washed to free it from the excess of potassa and chloride of potassium.

In the preparation of this body, it is proper to operate at a temperature of about 120° F. This compound is soluble at the ordinary temperature; it is capable of resisting, without being decomposed, a temperature which we have not determined, but which cannot be far short of 930° F.: more strongly heated, it assumes a slight orange tint, and then is suddenly decomposed with a violent detonation, being reduced entirely into gaseous products without residue. To obtain this compound possessed of the property of detonating in the manner described, it is necessary to conduct the precipitation in the way we have mentioned: if we operate without the aid of heat, or if we do not use sufficient potassa, less powerfully detonating precipitates are obtained, leaving a residue of oxide of mercury. Exposed to direct light, this body very soon turns black.

When this body is heated whilst still damp in a glass tube, it decomposes less violently and furnishes metallic mercury, water and acetic acid.

This substance is dissolved completely in hydrochloric acid, even without heat: it furnishes in this decomposition a very peculiar volatile matter of a pungent, irritating odor, which affects the throat in the same way as prussic acid. This matter may be separated by distilling the mixture: it is then obtained mixed with hydrochloric acid. We have not yet studied this volatile body as regards its composition, but we have observed that if nitrate of silver be added to it, we obtain with the precipitate of chloride of silver a soluble compound which crystallises in very fine transparent crystals. Sulphuric acid dissolves the mercurial body in question and forms crystalline compounds. Nitric acid also dissolves it: the nitric solution furnishes, with caustic potassa, an ashy grey precipitate, which, treated with hydrochloric acid, gives a volatile product having the same odor as that which is furnished in the same circumstances by the primitive compound which had been dissolved in nitric acid.

Acetic acid almost completely dissolves the same compound: the solution yields by evaporation a crystalline body.

The mercurial body in question, boiled with a solution of hydrochlorate of ammonia, drives off the ammonia: at the same time a soluble compound, which crystallises, is formed. A crystalline compound is also obtained by boiling the same body with a solution of bichloride of mercury.

Although we cannot at present form positive ideas concerning the composition of this singular body, we may, however, assert that it contains mercury, oxygen, carbon and hydrogen, and that these last elements are no longer in the same proportion as in alcohol, but that the hydrogen is in much smaller proportion; that this body acts as a very powerful base, and that it combines not only with sulphuric, nitric and acetic acids, but also with several others.

* *Comptes Rendus*, No. 3, July 21, 1851.

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In our researches, and by multiplying the reaction in different manners, we have also obtained compounds of mercury whose history should be connected with that of the body which we have briefly described. Thus a different body from the foregoing is produced, by slowly adding a very weak solution of potassa into a boiling solution of bichloride of mercury, &c.

If we make a solution of mercury in nitric acid, and drive off all the nitrous products by prolonged boiling, and if this solution be mixed with alcohol of 36 degrees, in the same proportions as adopted for the preparation of fulminate of mercury, there is no immediate reaction, provided that the mixture be made below the temperature of 212° F.; but if the heat of the mixture be raised to 212° F., a white crystalline compound is immediately formed, whose formation is not arrested by suspending the action of the heat. This reaction, however, rapid it may be, is not accompanied by any disengagement of gas. The precipitate contains oxide of mercury, nitric acid, carbon and hydrogen; treated with hydrochloric acid, it furnishes a volatile body having the same odor as that which is disengaged from the body which we have described at the commencement of this note, when treated by hydrocholoric acid.

It is to be foreseen that by reactions similar to those we have described, analagous compounds will be obtained, by substituting for ordinary alcohol, amylic and methylic alcohols, and by substituting for mercury other metals, such as silver, &c.

ON THE CHEMICAL NOMENCLATURE OF ORGANIC COMPOUNDS.*

BY DR. DAUBENY.

THE object of this paper was to point out certain inconsistencies and anomalies in the received method of classifying and naming organic compounds; and thus, if possible, to induce chemists to agree on a set of rules, by adhering to which the compositions and relations of a body might be inferred from the termination of the word designating it. The Professor first alluded to the nomenclature proposed by Gmelin, which imposed new names upon all known elements, and thus was as least as difficult as the acquisition of an entirely new language. Not conceiving that so intricate a system would ever come into vogue, he proceeded to point out the meaning belonging to the several terminations attached by eminent chemists to the names of bodies of their own discovery, as indicative of the class to which they belonged, and likewise their method of denoting the composition of a body by constructing for it a name made up of those expressive of its several ingredients. In order to introduce somewhat more of precision into this method of nomenclature, and also to render it in some instances more convenient and more applicable to daily use, the Professor submitted to the Section the following suggestions:—1. That the term *hydrocarbon*, when used to designate a class, should be confined to the compound radicals; the essential oils being regarded either in the light of hydrurets, from their containing an atom of hydrogen in a different state of combination from the rest, or of aldehydes, from their tendency to form acids by the addition of 2 atoms of oxygen. 2. That the term *æther*, as designating a class, should be restricted to the oxides of the respective compound radicals; and that "the compound æthers" should be named on the same principle that salts are, by terms expressive of their respective acids and bases. 3. That the term *cetone* should be retained for bodies produced from acids by the abstraction of a single atom of carbonic acid; 4. and that of *glyceride* for fixed oils. 5. That the termination *yle* for compound radicals, and *ene* or *en* for carbohydrogens with equal atoms of the two elements, be retained. 6. That to the vegetable alkalies produced by natural processes the termination *ine* should be confined; and to those artificially produced by substitution of hydrocarbons for the hydrogen atoms of ammonia that of *amine*. 7. That the names proposed by Hoffmann for the alkaloids of his own discovery should be abbreviated by introducing only the first syllable of the name expressive of each of the hydrocarbons present, by which expedient the length of the word so compounded need rarely exceed six syllables. 8. That the termination *amide* should be retained merely for bodies formed by the replacement of the hydrogen atoms *when they are not alkalian*; and that the terms *imide* and *nitrile* should be no longer employed. 9. That the termination *am* occasionally used for ammonia compounds, be discarded. 10. That the termination *al* for aldehyde compounds should be henceforward employed with more precision. 11. That the termination *ethane* should be used for those æther compounds only into which an acid does not enter. 12. That the termination *an* should be employed in a more definite

* *Meeting of the British Association*: from *The Athenæum*.

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sense than heretofore. 13. That the terminations *one* and *ole* should be respectively confined, the former to bodies produced from acids by the abstraction of 1 atom of carbonic acid, and the second by that of 2 atoms; so that the latter term should not be adopted to indicate the essential oils. 14. That where a name expressive of the composition of a body cannot be constructed, one should be formed having a reference to some obvious physical or chemical property, and of which the Greek or Latin root can be readily apprehended. Such barbarous and unmeaning terms therefore as mercaptan, kapnomor, pittacal, parabanic acid, &c., should be rejected from the vocabulary of science. 15. That bodies produced by natural processes should in general bear a name recalling the source from whence they are derived; 16, and lastly, That although bodies belonging to the same class or type should in general have the same termination, yet, that where a substance already familiar to us is shown to belong to a particular type, its designation ought not in that case to be altered, so as to bring it into harmony with the other other bodies with which it may be thus associated.

The above suggestions are thrown out rather as embodying the views of the most eminent chemists, so far as these views can be inferred from their practice, than as expressive of any new methods or arrangements conceived by the author of the paper; and in the former light are submitted to the Chemical Section, with the hope that the whole subject may be taken into consideration by a committee selected from that body, to whose suggestions on such a subject men of science in general might be disposed to refer.

NOTE ON A NEW COMPOUND OF VOLATILE OIL OF TURPENTINE.*

BY SIGNOR A. SOBRERO.

HUMID volatile oil of turpentine rapidly absorbs oxygen under the influence of light. A crystalline compound is formed whose composition is not susceptible of being expressed by any of the formulæ of the various hydrates of turpentine at present known.

To obtain this body, a phial full of water is reversed in water, and oxygen is afterwards passed in as far as four-fifths of its capacity, and volatile oil of turpentine is afterwards introduced in sufficient quantity for it to form a layer of about half a centimetre in the phial. The apparatus, thus arranged, is then exposed to the action of direct light. We very soon see formed on the internal surface of the phial, which is not touched by the water, a crystalline body which takes the form of small prismatic needles which go on increasing perceptibly in size, and which, in a few days, attain the length of 1 centimetre, or more. At the same time, the liquid rises in the phial which would be filled with it if care were not taken to arrange the apparatus in such a manner that the air may pass in, in proportion as the absorption takes place.

By arranging several phials in the manner described, a very considerable quantity of this crystalline body may be obtained.

To detach and purify this body, the phials are removed from the bath, and, after having allowed the water and oil to flow out, a little alcohol is poured into it, which rapidly dissolves the crystals; the solutions mixed together give by evaporation the crystallised body contaminated with a little oil of turpentine. It is purified by repeated crystallisations in alcohol and in water.

This body has no odor; it is soluble in alcohol, ether and water. Its boiling aqueous solution furnishes it in long prisms, arranged in stars.

This body is decomposed when boiled with water slightly acidulated with sulphuric acid, and gives a volatile product having a pungent odor resembling that of oil of turpentine and camphor. This character prevents its being confounded with the hydrate of turpentine of Wiggers, which, by this same reaction, gives a volatile oily body, possessing the odor of hyacinth.

The composition of this body is expressed by carbon, hydrogen and oxygen, in the centesimal proportions of:—

Carbon	70·58
Hydrogen	10·58
Oxygen	18·84
	100·00

and in equivalents by

Carbon	20
Hydrogen	18
Oxygen	4

its formula consequently, is

$$C^{20}H^{16}O^{2}+2Ho.$$

I hope shortly to be able to give a more detailed history of this body.

PREPARATION OF CHELIDONIC ACID.*

BY M. J. HUTSTEIN.

I PROCURED, last spring, several hundred pounds weight of *chelidonium* to prepare

* *Comptes Rendus*, No. 3, July 21, 1851.

* *Archiv. der Pharmacie.*

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chelidonic acid from it. I was thus enabled to verify the fact already announced by M. Lerch, that this herb furnishes most chelidonic acid when in full flower, and most malic acid when gathered when first budding. The following is the method which I adopted to obtain a pure product promptly.

Two hundred pounds of fresh *chelidonium* in full flower were expressed, and the juice boiled and filtered to separate the chlorophylle. To the clear filtered liquor, of a red brown and still hot, I added nitric acid of the density of 1·30, and in the proportion of one drachm to two pounds of juice, because of the malic acid always found in it. Then, by means of a solution of nitrate of lead, which I added as long as a crystalline precipitate was formed, all the chelidonic acid was separated in the state of chelidonate of lead, whilst the malate of lead remained in solution in the free acid. After the precipitate was completely deposited at the bottom, I separated it from the liquor and let it drain through a linen filter. A pound of this yellowish precipitate, after draining thoroughly, was washed in 10 pounds of distilled water, and I added to it sulphuret of calcium in solution as long as sulphuret of lead was precipitated. The colorless filtered solution of chelidonate mixed with a little hyposulphite of lime was evaporated at boiling heat, so as to decompose this latter salt, and after repeated filtrations, I obtained the calcareous salt under the form of small needle-like white crystals. To obtain the chelidonate of ammonia I dissolved the chelidonate of lime in six parts of boiling water, and treated it by a solution of carbonate of ammonia in slight excess. The carbonate of lime was separated by the filter and the chelidonic acid was liberated by pure hydrochloric acid.

NEW TEST FOR THE NITRITES AND NITRATES.*

BY G. C. SCHÆFFER.

CHEMISTRY has hitherto furnished no distinctive test for the nitrites when present in small quantities. From the supposed unfrequent occurrence of these salts, the want of such a test has never been felt.

For several years I have been engaged in a research which has led me to believe that the nitrites are of far more frequent occurrence than is commonly supposed, and that they have been mistaken for nitrates, as the usual process, with pure sulphuric acid and protosulphate of iron, will give the same reaction with both classes of salts. In order to settle the question, it was necessary to find a distinctive test, which should avoid all risk of confusion. I first tried acetic acid, which, as is well known, does not act upon the nitrates, while it decomposes nitrites. By substituting this acid for the sulphuric in the usual process, I succeeded perfectly. The test seemed even more delicate than for the nitrates, and was more elegant in its operation.

Still the following difficulties were to be encountered. The slightest quantity of peroxide in the sulphate gave a color with acetic acid, and injured the delicacy of the test. Moreover, the nitrites are generally either destroyed or converted into nitrates with such readiness that it would be almost impossible to concentrate their solutions.

At last I was led to the following process, which leaves nothing to be desired. To the solution supposed to contain a nitrite, add one or two drops of solution of yellow prussiate of potassa; there should not be enough to give a perceptible tinge to the liquid. A few drops of acetic acid are then to be added, and immediately, or in a few minutes, according to the quantity of nitrite present, the liquid assumes a rich yellow tint.

As the reagents used give nearly the same color, spontaneously after some time, even in pure water, it is better, when testing for minute quantities, to use two similar vessels, one containing pure water and the other the liquid under examination, to both of which the reagents are to be added in precisely equal quantities. The vessels should be equally exposed to the light, with a sheet of white paper behind them.

With these precautions, I have found this test astonishingly delicate, in fact ranking with those for iron, iodine, &c. Using fused nitre, I have detected the presence of 1 pt. in 617,000 pts. of water, a by-stander, wholly ignorant of the nature of the operation, pronouncing as to the color. Yet this salt contained about one-half its weight of undecomposed nitrate.

It should be remarked, that the presence of a large quantity of nitre has no influence upon this test, as with pure water it gives no color. The same reaction also answers for the hyponitrates.

The next step is to convert this test into one for the nitrates. The decomposition of the nitrates of lead and mercury by boiling with excess of their respective metals has long been known. The reaction of metals with the alkaline nitrates does not seem to have been studied. I find that nitrate of ammonia is readily decomposed in presence of metallic lead; and what seems surprising, nitrate of potassa is also decomposed, though not so readily.

* *Proceedings of the American Association, Newhaven*, 1851, p. 403.

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To test for the nitrates, we have only to agitate the slightly-warmed liquid for a few minutes with shavings of lead, and proceed as before. By a longer digestion, more of the salt would be converted into nitrite, and the color would be stronger. In estimating the delicacy of this process, I had used pure rain-water, but before completing the experiments I was obliged to be absent for several days. On my return, I soon found that the water from the same cistern contained so much of nitrates and nitrites, that it could no longer be used. From the readiness with which the decomposition was effected, I presume that nitrate of ammonia was present. The interval had been marked by the occurrence of frequent and severe thunder showers.

By using distilled water, I have been able to detect the presence of 1 part of nitre in about 60,000 of water, digesting with lead only a short time. Mercury containing a minute quantity of lead seems to answer better than lead for a time in the above process, but after long use it loses its effect. It will not answer to add to it any perceptible quantity of lead, as the liquid then becomes muddy on agitation.

Oxalic, tartaric and dilute hydrochloric acids may be substituted for the acetic, except when they produce precipitates, which would destroy the clearness of the liquid.

The yellow color produced in this test is the result of a complex decomposition. Everitt's yellow salt and red prussiate seem to be formed, and in some cases also very minute quantities of Playfair's nitroprusside.

ON THE TEST FOR NITATES, AND A NEW ONE FOR NITRITES*

BY DAVID S. PRICE, PH.D., F.C.S.

My attention having been directed to the detection of nitric acid in cases where, if it existed at all, its quantity could be but small, I deemed it necessary, as a preliminary step, to ascertain the merits of some of the tests usually adopted for that purpose. The experiments were confined chiefly to two reactions, generally considered the most susceptible for nitrates; the one where the indication of the presence of nitric acid is the production of a dark violet or brown color, caused by adding a solution of protosulphate of iron and concentrated sulphuric acid to a solution of a nitrate; the other, where it is the destructive action of nitric acid on indigo, the solution of the nitrate being made slightly acid with sulphuric acid, and then a solution of sulphate of indigo added. Before however detailing the results I have arrived at with respect to these tests, I shall proceed to describe a new one that has suggested itself for nitrates, but which admits, under certain circumstances, of application also for the detection of nitrates. Thinking that the addition of dilute hydrochloric acid to a solution of a nitrate in presence of iodide of potassium and starch-paste might cause the chlorine thus liberated to act in the nascent state on the iodide, and so produce the well-known blue color, I tried the experiment and found it to answer apparently most successfully. I was however surprised to find that of several nitrates employed, that of potassa was the only one with which the experiment succeeded; furthermore, that hydrochloric acid was not at all a necessary condition for the production of the blue color, oxalic, dilute sulphuric, and even diluted nitric acids effecting the same, whilst the same diluted acids produced no change in a single mixture of iodide of potassium and starch-paste. It was therefore evident that the action was not dependent on chlorine, but on some substance to be found in nitrate of potassa, and which will be demonstrated by the following experiments.

On distilling a few grains of nitre dissolved in 5 oz. of water with a small quantity of concentrated sulphuric acid, a distillate was obtained of slightly acid reaction, which when neutralised with carbonate of potassa and concentrated, and then added to a mixture of iodide of potassium, starch-paste and dilute hydrochloric acid, was found to produce a much deeper blue color than did a concentrated solution of the original nitrate. This led me to try the effect of the nitrites on the same test-mixture, and which I found to possess the property of liberating iodine under the circumstances described in a most remarkable degree, and which must be attributed to the reduction of hydriodic acid by nitrous acid. On subjecting the nitrate of potassa employed for the foregoing experiments to recrystallisation, the crystals then obtained were found to have entirely lost the property they originally possessed, whilst the mother-liquor retained it in a high degree, clearly showing that the peculiar action of the nitrate of potassa was to be attributed to the presence of a small quantity of nitrite. It has been shown that a very distinct indication of nitrous acid was obtained in the distillate from ordinary nitre and sulphuric acid; in order to see if such would be the case with small quantities of pure nitre

* *Quarterly Journal of the Chemical Society*, vol. iv. p. 151.

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when treated with pure sulphuric acid, I repeated the experiment, employing 2 grs. of the pure salt, 6 oz. of water and ½ an oz. of concentrated sulphuric acid, when, after treating the distillate in the manner before described, abundant proof was afforded of the presence of nitrous acid. In all cases therefore where distillation is necessary in searching for nitrates, this test may be indirectly applied for them. Those substances which interfere with the formation of iodide of starch under ordinary circumstances prevent its production also by the present test. The method of employing the test is the following:—A few drops of a dilute aqueous solution of iodide of potassium (free from iodate) are mixed with a little starch-paste, and then dilute hydrochloric acid of specific gravity 1006 added. The liquid suspected to contain a nitrite, if alkaline, must be slightly acidified with hydrochloric acid, and then added to the test-mixture, when, if much nitrate be present, a dark blue color will be instantly produced; and if very small traces only, then the liquid first assumes a pale fawn color, which gradually changes to that of violet, plum, and ultimately dark blue. The extraordinary delicacy of the test will be seen from the following experiments. When water containing only the $\frac{1}{1,250,000}$th part of nitrous acid, (as nitrite of soda, NaO, NO^3) is added to the text-mixture, a violet color is almost instantly produced; with the $\frac{1}{2,500,000}$th part, the color makes its appearance in a few seconds; with the $\frac{1}{5,000,000}$th part, after the lapse of two or three minutes; with the $\frac{1}{10,000,000}$th part, a change may be observed in twelve minutes; and with the $\frac{1}{50,000,000}$th part, a violet tint is produced in about fifteen minutes. In all these cases, the liquid rapidly assumes a dark blue color. By performing the experiments in a porcelain basin, the faintest indication of color may be observed. In searching for minute traces in a very large bulk of liquid, it is advisable to add more iodide of potassium than where the volume of the liquid is small. Since performing these experiments, I find that Schönbein* has noticed the action of nitrates on iodide of potassium.

With respect to the test for nitrates specified at the commencement of the paper, De Richemont† has found that by the employment of the first one he was able to detect the $\frac{1}{21,000}$th part of nitric acid in a solution. The one by means of indigo has had narrower limits assigned to it; Leibig*, who suggested it, states that the $\frac{1}{200}$th part of nitric acid may be recognised by it, and the $\frac{1}{500}$th part when a little chloride of sodium is added. I shall endeavour to show, that in both cases the action is in all probability due to nitrous acid contained either originally in the substance as nitrate, or produced by the action of sulphuric acid upon the nitrate; at any rate, that nitric acid in the cold has no apparent action upon either of them. At first, as regards the test with sulphate of protoxide of iron. If sulphuric acid be added to a solution of nitrate of potassa free from all nitrite, and briskly agitated with it, so as to prevent the mixture from becoming heated, and then a solution of sulphate of protoxide of iron added, no change whatever in the color of the liquid will ensue, even when allowed to stand for some time, which could not be the case did the action of the test depend on nitric acid. If to the same mixture one drop of a dilute solution of nitrite of potassa be added, a brownish color will be immediately produced, showing the instantaneous effect of nitrous acid upon the test. If, instead of keeping the mixture of nitrate of potassa and sulphuric acid cold, we gently warm it, and then add a solution of protosulphate of iron and a few drops more of concentrated sulphuric acid, a dark violet color will immediately appear, accompanied by an energetic disengagement of gas; the color in this case soon disappears, owing to the heat evolved, but can readily be reinstated by a fresh addition of the protosulphate of iron. Or again, if we first add a solution of protosulphate of iron to the solution of the nitrate, and then pour in the concentrated sulphuric acid in such a manner that it forms a layer at the bottom of the vessel, we shall find that a violet color will be produced at the contact-surface of the two liquids; the heat in this, as in the former case, being sufficient to cause the formation of nitrous acid. In searching therefore for small quantities of nitrates, it is advisable to add, as recommended by De Richemont, a large bulk of concentrated sulphuric acid. With respect to the delicacy of this test for nitrites, I have found that a liquid containing the $\frac{1}{2,500}$th part of nitrous acid (in the form of a soda salt) becomes immediately colored green upon the addition of a small quantity of sulphuric acid and sulphate of iron; that perceptible shades of green are produced when a liquid contains the $\frac{1}{500,000}$th, and a faint colorisation with the $\frac{1}{1,000,000}$th part. In like

* J. Pr. Chem. xlv. p. 227.

† Graham's Chemistry, p. 297.

* Gmelin's Handbuch der Chemie, i. p. 813.

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manner to the preceding test, I have found that a solution of pure nitrate of potassa, which has been treated in the cold with concentrated sulphuric acid or decomposed with tartaric acid, has no action whatever upon a solution of sulphate of indigo, but that the presence of the smallest quantity of nitrous acid is sufficient to destroy the same. By applying heat to the mixture of sulphuric acid and solution of nitre to which a few drops of indigo-solution have been added, the color of the latter will be found rapidly to vanish, and the test then becomes an exceedingly delicate one for nitrates, and in the absence of chlorates and organic matter may be most advantageously employed for them. I have examined the delicacy of the test for nitrites, and have found that the one, two and three millionth part of nitrous acid in a solution may be detected by means of it.

By all the foregoing tests it will be found that the sulphuric acid of commerce, as well as most kinds of carbonate of potassa, contain a trace of nitrous acid. In conclusion, I may state that I have applied the nitrites to the detection of the iodides, the results of which experiments will be found in the accompanying communication.

ON A NEW TEST FOR IODIDES.*

BY DAVID S. PRICE, PH.D., F.C.S.

HAVING in the preceding paper pointed out the principle on which the detection of nitrites by means of iodide of potassium and hydrochloric acid depends, I shall proceed briefly to describe the application of nitrites for the detection of iodides, and at the same time give one or two instances of the practical application of the test in cases where the quantity of iodine is exceedingly small.

The method of employing the test is the following. The liquid suspected to contain an iodide is mixed with starch-paste and acidified with hydrochloric acid; a solution of nitrite of potassa is then added, when, if much iodine be present, a dark blue color will be instantly produced; if a very small quantity only, as for instance the two or three millionth part, then a few seconds elapse before the blue color makes its appearance. In this manner I have detected the $\frac{1}{4000000}$th part of iodine dissolved in water as iodide of potassium. It will be seen that the test admits of a degree of delicacy not attainable by any of the other methods for detecting iodides, as well as being at the same time free from the disadvantages to which they are more or less subject; as, for instance, in the employment of chlorine, which, unless added very carefully to a liquid containing a trace of an iodine only, is almost sure to afford a negative result, from the chlorine combining with the iodine, and so preventing its acting on the starch. The same error may also arise by the use of nitric acid should the suspected liquid contain a large amount of chlorides.

I will now detail the two cases in which I have applied this test, in the one for the purpose of detecting iodine in cod-liver oil, the object being to see how small a quantity of the oil would suffice; in the other for the purpose of detecting iodine in marine vegetation. One ounce of ordinary brown cod-liver oil was saponified by a concentrated solution of caustic potassa, and then carbonised in an iron spoon over an open fire; the residue was removed into a covered porcelain crucible, and strongly heated, so as effectually to destroy all organic matter, and when cold was digested with a small quantity of water, and thrown upon a filter; the filtrate, being acidified with hydrochloric acid, was then mixed with starch-paste, and tested with nitrite of potassa, which almost immediately produced a pale plum color.

Sea-water contains so small an amount of iodine, that it is exceedingly difficult to detect even a trace of it in the mother-liquid from several pounds of water. Minute as this quantity must be, it nevertheless collected and assimilated by many marine plants, and the following experiment enables us to demonstrate its presence in their juices. If we take a thin transverse sectional slice of the stem of the *Fucus laminaria digitata*, moisten it with a little starch-paste and dilute hydrochloric acid, and examine it by the aid of the microscope, we shall, upon adding a drop of a solution of potassa to the same, be able most distinctly to observe the formation of iodide of starch. The presence of an iodide may be shown in a still more marked manner, by suspending the stem of the same plant in a dry atmosphere, when the surface, after the lapse of some hours or days, will become covered with numerous transparent crystals, which on examination will be found to consist principally of chlorides, but at the same time to contain so much of an iodine compound as to impart an intense blue color to the test-mixture.

Many marine plants, when placed in a fresh state in contact with the test-mixture, impart an orange color to it, owing to the liberation of bromine.

* *Quarterly Journal of the Chemical Society*, vol. iv. p. 155.

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II. CHEMICAL MANUFACTURES AND AGRICULTURAL CHEMISTRY.

CHLOROFORM AS A SOLVENT.*

BY M. P H. LEPAGE, PHARMACEUTIST AT GISORS.

HITHERTO little attention has been devoted except to the manufacture of this valuable agent, and the study of its anæsthetic properties. Several chemists, however, have mentioned, in passing, the faculty which it possesses of dissolving in a wonderful manner the essential oils, the fixed fatty bodies, camphor, resins, even those which are difficultly soluble in alcohol and ether, copal resin for example, iodine, bromine, the vegetable alkalis, caoutchouc, insoluble in alcohol and but little soluble in ether, and finally, gutta-percha, which is insoluble in these two menstrua, according to M. Vogel jun.

Having had occasion latterly, to cause chloroform to act on a variety of products, I thought that with a view to future applications, it might not be useless to make known the results which I observed.

The following is a summary of these results.

I. RESINOUS SUBSTANCES.

It will be remembered that M. Rabourdin, a distinguished pharmaceutist at Orleans, made, in the course of last year, an ingenious application of this property for the extraction of atropine from the juice of belladonna, and for testing the alkaloïds of the quinquinas. In an experiment which I have just made by acting on two quarts of the juice of belladonna, and by following with extreme precision the method adopted by that gentleman, I have not obtained the least trace of atropine. The precipitate occasioned by carbonate of potassa in the sulphuric solution gave up nothing to alcohol; finally, having dried and then calcined it, I discovered that this precipitate was nothing but magnesia. It weighed 1 gramme 60 centigrammes. I have likewise proved that the small quantity of water which had gone over in the distillation with the chloroform was *ammoniacal*; now, as I suppose that this alkali proceeded from the decomposition of the atropine, probably under the double influence of heat and of the slight traces of potassa which might have been retained by the chloroform solution, (it had however been washed four times with distilled water), I conclude that it might be advantageous to substitute the use of an *alkaline carbonate* for that of a caustic alkali. I intend to prove this at a fitting occasion.

Mastic resin, colophane, elemi, balsam of Tolu, benzoïn, are very soluble without heat and in all proportions, in chloroform, and their solutions in this liquid, constitute varnishes of which useful applications may, I think, be made, when chloroform is lower in price. As for gutta-percha, I have proved that it is perfectly soluble in it.

Copal resin and caoutchouc likewise dissolve almost entirely in this liquid, but more easily with than without heat.

Amber, sandarach and lac are only partially dissolved by chloroform, either cold or hot. The mixture of sandarach and chloroform divides into two layers; the inferior layer, which holds a certain quantity of resin in solution, is fluid, whilst the superior layer is of a gelatinous consistance.

Olibanum scarcely dissolves at all in chloroform, whether cold or hot.

The resins of guaiacum and scammony dissolve very well in it; whilst on the contrary the resin of *pure* jalap is insoluble in it; it only softens in contact with this liquid, and then swims on it under the form of a pitchy mass. When the resin is very pure, the inferior layer of chloroform is only of an amber tint.

Gamboge and dragon's blood likewise give up a portion of their substance to chloroform. The solution of gamboge being of a magnificent golden yellow, and that of the dragon's blood of a very fine red, these two substances might very advantageously serve to color the chloroform varnishes.

II. FIXED FATTY BODIES.

The oils of olive, cloves, almonds, castor, cod liver, colza, neatsfoot, linseed, euphorbium, lathyris, croton tiglium, lard, suet, the concrete oils of palm and cacao, spermaceti, and probably all the fixed fatty bodies, dissolve freely and in all proportions in chloroform. As for wax, it will be remembered that, according to M. Vogel, jun., 6 to 8 parts of chloroform put in contact with part of this substance when

* *Journal de Chimie Médicale*, August 1851.

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pure, only dissolve 25 hundredths, whence this chemist thinks that whenever wax treated by this liquid in the above proportions, leaves less than 75 per cent. of residue, it may be considered as mixed with suet or stearic acid.

I put 7 grammes of chloroform and 1 gramme of *pure* white wax into a small tube; I was careful to agitate the mixture frequently; at the end of six or eight hours the piece of wax had completely disappeared and the contents of the tube resembled an emulsion. I poured the whole on a small filter of the weight of *one gramme*. A *transparent* liquid passed through, which by spontaneous evaporation left a residue of pilular consistance, weighing 25 centigrammes; on the other hand, the filter which retained the undissolved portion of the wax, left in the free and dry air until it lost no more weight, weighed *one gramme seventy-five centigrammes*. The result of this experiment therefore confirms the fact stated by the learned chemist of Munich.

III. VOLATILE OILS.

Are all soluble in chloroform.

IV. SIMPLE METALLOID BODIES.

It was already known that iodine and bromine were soluble in chloroform; I have proved that phosphorus and sulphur are likewise sparingly soluble in it.

V. NEUTRAL PROXIMATE PRINCIPLES.

Styracine, piperine, naphthaline, and cholesterine are very soluble in chloroform. Picrotoxine is but sparingly soluble.

Paraffine only dissolves in it with the aid of heat, and, on cooling, collects on the surface of the liquid.

Amygdaline, phloridzine, salicine, digitaline, cynisine, urea, hæmatine, gluten, sugar, etc., are insoluble in it.

VI. ORGANIC ACIDS.

Benzoïc and hippuric acids are very soluble in chloroform. Tannin only dissolves in small quantity in it.

Tartaric, citric, oxalic and gallic acids are insoluble in it.

VII. ORGANIC ALKALIS.

Quinine, pure veratrine, emetine and narcotine are readily soluble in chloroform.

Strychnine likewise dissolves very well in it, and the solution, even when not saturated, (1 decigramme to 2 grammes of chloroform for example) deposits in 24 hours a multitude of small tuberculiform crystals, which very possibly might be a modification of this alkaloïd (an isomeric state), for their solution in dilute acid appeared to me less bitter, and less easily precipitable by ammonia, than that of ordinary strychnine. Still I have not found that the action of tannin was exerted in a more sensible manner on the solution of the one than on that of the other.

Brucine is likewise decidedly soluble in chloroform.

Morphine and cinchonine are insoluble in it.

VIII. SALTS OF ORGANIC ACIDS.

Emetic, the acetates of potassa and of soda, lactate of iron, citrate of iron, valerianate of zinc, and acetate of lead do not dissolve in chloroform.

IX. SALTS WITH ORGANIC BASES.

Sulphate and hydrochlorate of strychnine are very soluble in chloroform, whilst sulphate of quinine, hydrochlorate and sulphate of morphine are insoluble in it.

X. HALOID SALTS.

Iodide and bromide of potassium, the chlorides of soda, potassa and ammonia, the iodides of mercury and lead, yellow prussiate of potassa, the cyanides of mercury and potassium do not dissolve in chloroform.

Chloride of mercury is soluble to a considerable extent in it.

XI. OXYSALTS.

The alkaline iodates, chlorates, nitrates, phosphates, sulphates, chromates, borates, arseniates, and hyposulphites are completely insoluble in chloroform. It is the same with nitrate of silver, sulphate of copper, and very probably all the metallic oxysalts.

SUMMARY AND APPLICATIONS.

The above observations show:—

1st. That chloroform dissolves, with some rare exceptions,* the bodies soluble in hydric ether; but as it dissolves copal, caoutchouc etc., much better than this latter, this property will not fail to find applications when the price of chloroform is lowered.†

2nd. That lac is less soluble in it than in alcohol, contrary to what has been said.

* It does not dissolve gun-cotton, as I have already mentioned in a note published in the *Journal de Chimie Médicale*, vol. for 1849, p. 147.

† In fact, if ether, in consequence of its inflammability and great volatility, cannot be used as a solvent in the preparation of varnishes, it will not be the same with chloroform, which is not inflammable, and the boiling point of which (141° F.,) is much higher.

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3rd. That it may be employed instead of and in the place of ether, to separate quinine from cinchonine, narcotine from morphine, the resin of guaiacum from that of jalap, which are sometimes found mixed in commerce.

4th. That it dissolves, in very large proportions, strychnine, brucine and emetine, alkaloïds which are almost insoluble in ether.

5th. Finally, that it does not dissolve tartaric, citric, oxalic and gallic acids; amygdaline, phloridzine, salicine, digitaline, hæmatine, gluten, etc., bodies soluble in alcohol, nor the chlorides, bromides, iodides, and nitrates, salts soluble in the same vehicle.

APPENDIX.

I think I ought to mention the following observation, because it in some measure corroborates a fact recently mentioned in the *Journal de Chimie Médicale*, by my friend, M. Augendre, assayer to the mint, at Constantinople, namely, that chloroform possesses some interesting properties as an antiseptic.

Having accidentally left in a bottle, corked but not filled, for a month, (from the tenth of April until the twelfth of May), in my laboratory, where variations of temperature are very frequent, some chloroform mixed with milk, in the proportion of a hundredth, I was somewhat surprised on examining the milk, to find that it had preserved the fluidity and homogeneousness of the same liquid when newly drawn, and more, that it bore boiling without *turning*.

CHEMICAL PRODUCTS OF PEAT.*

A report on the chemical products of Irish peat has been presented by Sir Robert Kane, the Director of the Museum of Irish Industry. The inquiry was undertaken at the suggestion of Lord Clarendon, in consequence of the numerous applications for information by foreign authorities, and by individuals interested in the welfare of Ireland, consequent upon the announcement of the method patented by Rees Reece and the establishment of the Irish Peat Company. The two principal points to be arrived at were the actual nature and quantities of the products that could be obtained, and the economic conditions of the process so as to determine its importance as a commercial speculation. With regard to the first—namely, the products obtainable—the result of the experiments was to establish the general correctness of Mr. Reece's statements, the comparison of the materials gained by that gentleman with those gained by Sir Robert Kane being as follows:

From 100 parts of peat.	Statement in Mr. Reece's prospectus.	Average results of Museum trials.
Sulphate of ammonia	1·000	1·110
Acetate of lime.....	·700	·305
Wood naphtha.....	·185	·140
Paraffine.....	·104	·125
Fixed oils.....	·714	1·050
Volatile oils.....	·357	

With regard to this comparison, Sir Robert Kane remarks:

"It is evident that the quantity of ammonia obtained is rather greater than that expected by Mr. Reece; secondly, that the quantity of oils and paraffine may be considered the same; thirdly, that the quantity of wood naphtha expected by Mr. Reece is more than we obtained in average, but not more than was obtained in some Museum trials. That the quantity of acetate of lime expected by Mr. Reece is more than double that which was in average obtained in the Museum, unless the commercial acetate of lime calculated for by Mr. Reece shall contain such excess of lime, &c., as shall render its weight double that which the pure article, calculated in the result of the Museum trials, should have. This latter circumstance may possibly explain the difference.

"It may, therefore, be admitted that the statements made as to the quantities of those bodies obtainable from peat have not been exaggerated, and, indeed, are such as should immediately be inferred to be obtainable from a body of its constitution compared with coal and wood."

The amount of product being thus determined, the Report touches upon the other question; namely, the cost of its production. This is described to be so difficult as to preclude the possibility of any absolute conclusions. The facts that the manufacture is of a novel character, involving numerous and complex collateral operations, and that it is to be established in localities and amongst populations unaccustomed to manufacturing industry, are referred to as calculated to have an important influence in augmenting the expense. At the same time also some strong doubts are expressed as to the practicability, on a large scale, of the mode upon which Mr. Reece relies for an inexpensive supply of the heat necessary for conducting his entire operations, which consists in employing as fuel the gas produced in the blast furnaces by the distillation of the peat

* *Mechanics' Magazine.*

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after all their condensible vapours shall have been secured. On the whole, however, even the conclusions thus arrived at, and which have evidently been framed with all the caution that would be generated by a sense of the responsibility of encouraging extravagant views, are not unfavorable to the hope that the process on its introduction may prove sufficiently profitable, and that eventually, as the difficulties attending it shall gradually be lessened by experience, it may realise some of the sanguine expectations originally indulged in regarding its possible influence in the regeneration of Ireland. Subjoined is the final paragraph of the Report:—

"Although the excessive returns stated by the proposers of the manufacture may not be obtained, it is yet probable that, conducted with economy and the attention of individual interests, the difficulty connected with so great complexity of operations would be overcome, and the manufacture be found in practice profitable; and certainly it must be regarded as of very great interest and public utility that a branch of scientific manufacture should be established specially applicable to promote the industrial progress of Ireland by conferring a commercial value on a material which has hitherto been principally a reproach, and by affording employment of a remunerative and instructive character to our labouring population."

NEW DEVELOPEMENT OF PHOTOGRAPHY ON GELATINE.*

BY M. A. POITEVIN.

SINCE M. Balard did me the honor of communicating to the Academy of Sciences, at its sitting of May 27, 1850, my process of Photography on Gelatine, I have applied myself, as much as possible, to modifying this process, in order to expedite the preparation of the gelatinised plate, and to produce a more certain result.

I. ON THE CHOICE OF THE GELATINE, ITS PREPARATION AND ITS APPLICATION IN A THIN LAYER ON THE SURFACE OF GLASS PLATES.

All the transparent gelatines of commerce are not equally fit for photographic purposes: some contain traces of a salt of iron (chloride of iron, doubtless); these should be rejected, because they turn black with gallic acid; others do not form a good jelly when dissolved and run on the surface of the plates.

The following are the proportions of gelatine, iodide of potassium, and nitrate of silver which I have employed from last December to last April, during which period, I operated at a temperature of from about 53° F. to 59° F.

The gelatine being cut into small pieces, one gramme of it is put into a small porcelain capsule with 80 grammes of distilled water; after steeping it for at least ten minutes, it is melted with a gentle heat; the solution is then skimmed and 15 drops of a saturated solution of iodide of potassium (14gr. 80 to 10 grammes of distilled water) is added. It is mixed perfectly with a spatula of white wood, again skimmed, and if the gelatine is impure the solution is filtered through a cloth, then 4 or 5 drops of a solution of iodine in a dilute solution of potassium are added; but this is not absolutely necessary. From 10 to 12 cubic centimetres of solution of gelatine are taken up with a pipette and run on the surface of the glass plate, placed horizontally on a level support, and gently heated over a lamp, in order that the gelatine may retain sufficient fluidity to be spread all over the surface with the spatula, then raising the plate by one of its angles, the excess of gelatine is run into the capsule, then allowed to set on the surface, and is afterwards placed on a horizontal and cold surface in order that it may become more solid; a plate of marble answers very well.

By slightly re-heating the solution of gelatine remaining in the capsule, another plate may be prepared, and so on.

After at least 10 or 15 minutes of repose, on the horizontal table, the gelatine has acquired sufficient consistence on the surface of the glass; in warm weather 15 minutes would not be sufficient; in this case, instead of 1 gramme of gelatine to 30 grammes of water, 1·5gr. or 2 gr. may be employed.

The thin layer of gelatine being formed into a jelly, the glass plate is placed, the gelatinised surface downwards, on an ordinary iodising box, for 4 or 5 minutes, when the disengagement of iodine is not very powerful; it is better to iodise too little than too much, for then the gallic acid stains the proof.

II. APPLICATION OF THE IMPRESSIONABLE LAYER.

The plate being iodised, it is inclined over a bath of nitrate of silver placed in a basin with a flat bottom; this bath is composed of 10 grammes of nitrate of silver dissolved in 100 grammes of distilled water. When the quantity of gelatine is increased in the solution of which I have just spoken, the

* *Comptes Rendus*, No. 26, 30 June, 1851.

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quantity of nitrate of silver in this bath should be diminished. For 2 grammes of gelatine, for example, dissolved in 30 grammes of water, we succeed very well with a solution of nitrate of silver containing, in 100 grammes of distilled water, 6 grammes of nitrate. It is advisable to keep this solution in a cool place sheltered from the light, or to steep the bottle containing it in cold water before using it. The same should be done with the solution of gallic acid of which I shall speak further on. In treating the plate with nitrate of silver several precautions must be observed. The gelatinised surface being turned downwards, one of the extremities of the plate is placed against one of the sides of the basin; then, sustaining the other extremity of the plate with a small glass crochet, the plate is regularly inclined over the bath, until the whole of the surface has been moistened with the liquid; the surface of the plate not having touched the bottom of the vessel, it is removed and immersed in the bath, the gelatinised side uppermost. This immersion may last from 10 to 12 seconds, after which, the plate is removed, the whole of the ungelatinised surface is dried, and it is placed in frame of the camera, the layer of gelatine being turned towards the object glass, and the back of the plate preserved from the light by a piece of cardboard. It is good to filter the solution of nitrate of silver when it is used.

Another mode of immersion may be employed: for that purpose the solution of nitrate is put in a glass or porcelain vessel not very broad and very deep, so that it contains very little solution, and that the glass may be slipped in; this means is even preferable to the former.

The glass plate being placed in the frame, the latter should be kept in a horizontal position until it is placed in the camera.

III. OF THE EXPOSURE IN THE CAMERA; OF THE TREATMENT WITH GALLIC ACID AND OF FIXING THE PROOF.

To reproduce a very light landscape, and with the single object-glass, it ought to be left for 1 or 1¼ minute; for portraits and with the double object-glass, it requires very nearly the same time. I should here say that we may employ with gelatine all the accelerating substances hitherto proposed, with the exception, however of acetic acid, which deprives the solution of gelatine of the property of forming a jelly. I have ascertained that by adding a small proportion of gum arabic to the solution of gelatine the layer was rendered more sensitive.

The exposure to the camera being over, the glass plate is placed on a support and a solution of gallic acid containing at most 0·5gr. of gallic acid in 100 grammes of distilled water is poured on its surface. The proof is then allowed to come until the shades are very intense. To fix the proof, the plate is washed in a large quantity of water, and then steeped in a solution of hyposulphite of soda, until all the iodide of silver, which gives to the gelatine a milky appearance, has entirely disappeared: this solution some times requires a long time. It is afterwards washed in an ordinary bath, to remove the hyposulphite, for one or two hours, and with ordinary distilled water, which is poured on the surface, then the layer of gelatine is allowed to dry.

These designs are copied on ordinary positive paper. In all these operations, darkness is indispensible only for the passing of the plate to the solution of nitrate of silver, and from the latter to the gallic acid. Distilled water is employed only for the solutions and for the final washing of the proof.

HYALOTYPE, OR PHOTOGRAPHY ON GLASS.

To the Editors of The Chemist.

GENTLEMEN,—I take the liberty of addressing to you a few lines, in the hope they may be interesting, as well as instructive, to junior amateurs of photography on glass. I have used several different solutions in my manipulations, but do not find any to succeed so well as the following very simple recipe, which, to all appearance, gives a more defined picture, with darker shadows, and, in a reflected light, the most clearly delineated positive, brilliantly white lights, and deeper shades than with any other preparation.

First, then, I take a phial of any small size, and put into it some grains of nitrate of silver and some iodide of potassium, rather in excess; then pour on the same a quantity of pure ether, which soon dissolves as much as it is able; I shake this mixture well, and leave it to rest for some hours. The nitrate of silver and iodide of potassium not taken up in solution lie at the bottom of the bottle; apparently the ether takes up very little into solution, but quite enough for taking good pictures.

After the lapse of three or four hours, procure an ounce or two-ounce bottle, and pour into it a small quantity of collodion, as obtained from the druggists, and then the same with the ether solution of iodide silver, as above, trying its opacity, on a

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piece of glass, which, when dry, should be quite transparent, and yet sufficiently impregnated with the collodion to be adhesive to the glass, to avoid being washed off in the after process.

This mixture should remain at least six or eight hours before use, after having been well mixed and shaken from time to time; but I had almost forgotten to state I always keep a small lump of iodide of potassium in excess in this mixture, thereby maintaining the same strength throughout.

After coating the glass with the above, and before the ether entirely evaporates, I plunge it into a bath of 30 grains nitrate of silver in 1 ounce of distilled water, and move about until the greasy appearance has ceased; drain it and immediately put in the slide of the camera, which, in a clear day, with a good double lens, takes from a quarter to half a minute for a good picture. I then develope with pyro-gallic and acetic acids, as already described in papers published in THE CHEMIST, by various authors. I should say, take rather an excess of time in developing; i.e., until the pyro-gallic acid becomes of quite a dirty appearance, using plenty of it on the surface to develope. This immediately washes off in water; then fix by a nearly saturated solution of hyposulphite of soda, and wash again. For the guidance of junior amateurs, I may mention that, the picture, when under the influence of this last solution, appears to undergo a complete change, perceptible to the eye, as if it were completely vanishing, and reappearing under its dissolving powers.

I find that some of my best pictures have been taken by the above process, even when there has not been a particle of sun apparent, but in fact were taken on obscure cloudy days; and I have now before me two specimens of very good pictures taken yesterday evening, at eight and half-past eight o'clock, the sun being completely below the horizon; of course a little longer exposure in the camera is necessary, say from two to two and a half minutes at most. The best way of securing pictures on glass from being rubbed off, is, by pouring completely over the surface clear spirit of wine varnish, and draining at one corner, which will dry in three or four minutes, in a stove or over a spirit-lamp, without fear of losing the impression. These pictures are fully as beautiful as Daguerreotypes, and delineate the little niceties quite equal, if not superior to it, and possess the double advantage of being positive pictures in themselves, or negative ones for copying upon paper.

I beg to remain, gentlemen,
Yours respectfully,
Fairfield Cottage, C. J. DEVEY.
Handsworth, 12th Aug. 1851.

EXPERIMENTS FOR THE PURPOSE OF SHOWING THAT, IN THE PROCESS FOR THE REPRODUCTION OF IMAGES, DUE TO M. NIEPCE DE SAINT VICTOR, THE IODINE ACTS, NOT BY VIRTUE OF AN ELECTIVE AFFINITY, BUT IN CONFORMITY WITH THE COMMON LAWS OF CHEMICAL AFFINITY.*

BY M. BENARD.

In a work on the properties peculiar to some chemical agents, and especially to the vapor of iodine, the author, M. Niepce de Saint Victor, says, "He first discovered in iodine the property of adhering to the black parts of an engraving, or of a writing, to the exclusion of the white portions." This sort of elective affinity of the vapor of iodine appeared to me inadmissible, and it struck me that, without having recourse to an *exceptional law*, it would be possible to find the explanation of the phenomenon in question in an application of the general law which regulates all chemical bodies, that of affinity. The explanation of these phenomena by the chemical theory is the end which I had in view, for which purpose I made some experiments.

On an engraving prepared as directed by M. Niepce, I spread a certain quantity of iodine in fine powder; after one or two seconds of contact, I removed the iodine, slightly shaking the engraving to remove the non-adherent iodine. Thus prepared, the engraving was applied to some starched paper: it gave me a proof in every respect similar to that obtained by M. Niepce. It is evident that in this case the presence of iodine on the white portions was incontestible.

Nevertheless it might still be said that the affinity of iodine for the black parts was proved, because in shaking the engraving, the black parts only retained it, hence the reproduction of the image. To be certain that a layer of iodine remained uniformly on the whole surface of the paper, I employed the following process: without any previous preparation, I spread the iodine on an ordinary engraving, I then put it on a starched paper, and there was no result; that is to say the shadows and lights were

* *Comptes Rendus*, 14 July, 1851.

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all confounded. I repeated the same operation, but this time I placed upon the engraving a piece of unsized paper soaked in alkaline water, and the image was perfectly reproduced. Hence, it is evident that the reproduction of the engravings is due to the preparation of the paper, and not to any peculiar property of the vapor of iodine.

This experiment repeated several times in various ways, resulted to me in the conviction that it is impossible to admit the presence of iodine only on the shadows. Let us see how images are reproduced.

There are two ways of operating, with or without preparation.

In the case where the operation is made without preparation, I am of opinion that the first portions of vapor of iodine which reach the white parts combine with the paper or with the size of the paper, and this appears to me essential for the reproduction of the image. Indeed when the exposure of the engraving is prolonged, the white parts are colored, and the reproduction is only very clearly made when this excess of iodine is removed. Should my opinion be disputed, I would ask where is the limit to affinity of iodine for black, as a moment arrives when it extends to the white portions. I think that this limit is reached when the iodine does not combine with the paper; all the vapor beyond that point remaining free.

If the disengagement of the vapor of iodine is arrested at the exact moment that the paper refuses to absorb and retain it in combination, the reproduction will take place, because in this case the white parts retain the iodine. If this moment is allowed to pass, the reproduction will only take place, as stated by M. Niepce, after several successive applications to the starched paper, in consequence of the inequality of the layer of iodine, an inequality which I likewise admit, but which I explain by the combination of the first portions of iodine with the white paper; then arrives a moment when some iodine remains on the shadows, whilst there exists some on the white parts as well, it is true, but in a state of combination Let us see how the vapor of iodine behaves on reaching a prepared engraving. It will be already conceived after what I have said, the action will differ according to the nature of the body which it encounters. The vapor is in the presence of black and white. The white being saturated with ammonia forms a fixed iodide undecomposable by starch (the alkali, on the contrary, removes the iodine from iodised starch). On the black, on the contrary, it either is deposited and remains free (in this case it is understood that it combines with the starch), or there is formed an unstable combination which combination is destroyed when the engraving is applied to the starched paper, by the free acid in which this paper is steeped at the moment of the operation. The reproduction on metal is explained in a similar manner.

ON INSTANTANEOUS PHOTOGRAPHIC IMAGES.*

BY H. P. TALBOT, ESQ.

THE rapidity with which photographic images are obtained on sensible plates is so great that they are sometimes called instantaneous; but this only a form of expression: in strictness, they are far from being so; for all objects which move with great speed have hitherto eluded photographic representation.

I have lately found a means of rendering the plates extremely sensitive, which leads me to hope that I may ultimately be able to obtain a really instantaneous image, which no object could escape, whatever the force of its motion. Experiment has fully answered my expectation, and I have assured myself of this in the following manner.

I fixed a printed paper on a circular disc to which a rapid rotatory motion was given. I arranged a camera obscura containing a very sensible plate, in a convenient position for reciving the image of this disc, which I had placed quite close to a large electrical battery. I closed the volets of the camera, and turned the disc as quickly as possible; I then opened the camera, and discharged the electrical battery: the discharge spread a vivid and instantaneous light on the disc; I then withdrew the plate from the camera, and, on examining, I had the pleasure of finding that it had received the image of the printed letters.

I did not notice any want of clearness in this image; it appeared to me absolutely the same as if the disc had been stationary.

I intend very soon to submit to the Academy the method which I adopt for rendering the plates as sensible as this experiment requires.

* *Comptes Rendus*, No. 25.

ALLOY FOR TAKING CASTS OF MEDALS.

To the Editors of The Chemist.

GENTLEMEN,—As the advantages possessed by metallic moulds over all others must be

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obvious to everyone who has had the least experience in electrotype manipulation, I need not occupy your valuable space by enumerating them. Of all the alloys which I have tried, the two following are, I think, the best. First:—

Bismuth	8 parts.
Tin	2 ,,
Lead	5 ,,
Mercury	1 ,,

This is peculiarly applicable for taking impressions from plaster medallions because of the low temperature at which it melts.

The other is,

Antimony and lead, equal proportions.

This alloy is hard, and from its expansion in cooling forms very sharp castings.

Hoping that I have not trespassed too much on your space,

I remain, gentlemen,
Yours respectfully,
Brompton. A. C. W.

ABSTRACTS OF SPECIFICATIONS OF CHEMICAL PATENTS RECENTLY ENROLLED.*

Improvements in preserving animal and vegetable substances. JAMES MURDOCH, of Staple's Inn. (A communication.) Patent dated January 30, 1851.

The first part of this invention consists of a method of preserving animal and vegetable substances by exposing them to the action of a current of dry air of a slightly elevated temperature, by which means the veritable preservation of the substances operated on is effected in their normal state.

The apparatus employed consists of a fireplace with horizontal tubes or channels for heating and drying the air; a chamber provided with shelves or ledges, on which the articles may be placed, or rods or bars from which they may be suspended; and a fan or other mechanical contrivance by which a current of heated air is forced through the chamber to act on the substances contained in it. The temperature of the air and the continuance of the operation vary necessarily with the state and nature of the articles to be treated, but a temperature of from 65° to 85° F., and a time of from twenty-four to forty-eight hours is recommended as suitable for most articles—vegetables, such as cabbage, cauliflower, spinach, beet-root, carrots, potatoes, &c., fish of all kinds, poultry, game, and animal flesh, may all be subjected to the above-mentioned desiccating process after undergoing in certain cases preliminary cleansing and other operations, and they may be subsequently treated in any way that may appear suitable.

The second part of the invention consists of a method of composing a saline solution applicable to the preservation of animal substances, such solution being used alone, or preliminary to the above described system of desiccation, or in conjuction with any other process of preservation. This solution is composed of 10½ ounces of chloride of aluminum, 10½ ounces chloride of sodium, and 3½ ounces of nitrate of potassa dissolved in 2½ wine pints of water, and is applied by injection to the carcases of animals in quantities varying with the sizes of the animal operated on.

The process of desiccation first described is recommended as suitable for treating glue made during the same months, in order to dry it for preservation.

Claims.—1. The exposure of animal and vegetable substances in suitable chambers to the action of a forced current of dry air, in order to dry such substances for the purpose of preserving them, and independently of any preliminary or subsidary processes or methods of treatment.

2. The injection of the carcases of animals with a saline liquid, for the purpose of preserving them, whether such injection be employed alone or in conjunction with the desiccating process above described, or any other preliminary or subsidiary process that may be deemed advisable.

Improvements in the process of and apparatus for manufacturing soap. JOHN RANSOM ST. JOHN, of New York, engineer. Patent dated January 21, 1851.

In carrying into effect that part of his invention which relates to "the process of manufacturing soap," the patentee prepares a lye from soda-ash and lime, using 100 parts of the former to 40 parts of the latter, with sufficient water to bring the mixture to 10° proof. To every pound of this lye, in a hot state he adds 6 lbs. of tallow and lard stearine, or its equivalent in palm oil, cocoa-nut oil, or lard, and boils the whole well, skimming off the upper portion from time to time, and thus obtaining "fullers' soap" for subsequent treatment. Or, instead of adopting the above process, the patentee employs the ordinary "fullers' soap" of commerce. In either case, he heats the "fullers' soap," and adds gradually to every 100 lbs. thereof about 50 lbs. of Paris white or of common whiting, or silicate of magnesia, previously well mixed with 15 gallons

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of water. He then boils and stirs the mixture, and adds to it 12 lbs. of common resin, and continues the application of heat until the resin is dissolved, taking care not to raise the temperature to the boiling point lest bubbles should be formed, by which the soap would be deteriorated: or the resin may be used as the last ingredient in preparing the fullers' soap. He next mixes with the heated preparation 14 lbs. of sal-soda, and after stirring for a short time, 2 lbs. of biborate of soda, or borax, or its equivalent of tincal or other compound of borax, and finally a mixture of 3 lbs. of starch or boiled potatoes with 1 lb. of water, in the proportion of 20 lbs. of the mixture to every 100 lbs. of soap. In order to ascertain whether the boiling has been continued long enough, a trial should now be made of the soap by pouring some of it into a vessel—when, if it sets or hardens quickly, the whole of the contents of the soappan may be run off into shallow coolers, or into frames; in which latter case it may be found necessary to crotch or stir the soap during cooling, to prevent the separation of the ingredients. In order to facilitate the hardening, 1 lb. per cent. of rice flour may be added to the soap while in the pan; but when silicate of magnesia is employed in its preparation, the addition of rice flour is not necessary, as this material possesses in it the requisite hardening properties.

The "improved appartus" consists of a pan or kettle, with a casing or jacket, between which and the bottom of the pan the steam employed for boiling circulates. A number of vertical pipes, closed at the top, and communicating at bottom with the steam space, rise into the kettle, and as the steam occupies the interior of these pipes, the boiling operation is facilitated, and the heat uniformly diffused through the contents of the kettle. A horizontal arm, mounted on a vertical shaft in the centre of the kettle, to which rotary motion is communicated by any suitable means, and provided with scrapers extending downwards to the bottom of the kettle, and so arranged as to pass between the vertical pipes, is employed to effect the stirring.

Claims—1. The combination of materials above set forth, for the purpose of producing a soap which may be used with hard or soft, fresh or salt water; and particularly the use of biborate of soda, borax, tincal, or any substance containing these elements, in combination with the above specified or other materials.

2. The employment of the apparatus above described, when used for boiling soap.

Improvements in coating metals with other metals. HENRY GRISSELL, of the Regent's Canal Iron Works, and THEOPHILUS REDWOOD, of Montague Street, professor of chemistry. Patent dated January 11, 1851.

1. To coating iron with zinc, the patentees melt the zinc in an open bath or vessel of suitable size, and place on its surface a stratum of chloride of zinc (obtained by dissolving zinc in muriatic acid, and evaporating the product to dryness), or of a mixture of chloride of zinc and chloride of potassium in the proportions of eight parts of the former to ten of the latter, or of a mixture of equal parts of chloride of zinc with chloride of sodium, or anhydrous sulphate of zinc with chloride of potassium or sodium. When the salt is in a state of fusion the metal to be coated is placed in the bath, and allowed to remain there till a coating of sufficient thickness has been obtained; it is then withdrawn, and any parts of its surface imperfectly covered are sprinkled with sal-ammoniac, and the sheet of iron again immersed in the bath.

2. For coating zinc, or iron coated with zinc or other metal, with metallic alloys, the alloy employed is melted in an open vessel, and a stratum of chloride of zinc mixed with equal parts of sal-ammoniac deposited on its surface. The iron or other metal is then plunged into the molten bath, and allowed to remain there until a coating has been deposited in it.

One of the alloys which the patentees employ consists of 96 parts of tin, 10 parts of zinc, and 5 parts of lead, but they do not confine themselves to these proportions. They also use the alloy known as "fusible metal," the proportions of which may be varied: provided always a melting point less than 400° F. be ensured. A "fusible metal," suitable for the purpose is composed of 8 parts bismuth, 5 parts lead, and 3 parts tin.

3. To coat iron or other metals with tin or tin alloyed with lead, the tin or alloy is first melted as before directed, with a stratum of chloride of zinc and sal-ammoniac on its surface, and the iron or metal to be coated is immersed in the molten metal until sufficiently covered. The patentees here observe, that it will be found advantageous to remove the sheet of metal undergoing coating from the bath at intervals, and again immerse it in order that its surface may be brought well in contact with the fused salt. They also recommend that the sheet of metal should in the first instance be dipped into a hot solution of chloride of zinc acidulated slightly with muriatic acid.

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4. For coating iron or other metals with silver, or any alloy of silver and copper, the metal to be coated must be first amalgamated with mercury. In the case of iron, the following is the process adopted:—12 parts of mercury, 1 of zinc, 2 of sulphate of iron, 2 of muriatic acid, and 12 of water, are mixed together and heated in an open vessel to about 200° F., the iron is then immersed, and the mercury rubbed in its surfaces until amalgamation is effected The silver or alloy is to be melted in a crucible, and the amalgamated iron placed therein, when a coating of silver or alloy will be deposited.

5. To coat iron with copper or brass, or with any alloy of copper, with zinc, lead, or tin, the copper or other coating is to be melted in a suitable vessel, and a stratum of borosilicate of lead (obtained by calcining together 24 parts boracic acid, 112 parts oxide of lead, and 16 parts silica) placed on its surface; the iron is then to be plunged into the molten metal, and retained there until a coating is deposited on it. Iron coated with tin or lead, or amalgamated as before described, may be also treated in a similar manner. Another method of coating iron with copper is, to place in a crucible a quantity of chloride of copper, upon which is laid the iron to be coated, and over that a quantity of charcoal. The crucible is then submitted to a red heat, and the chloride of copper fused, and a coating of copper deposited on the iron. Or, the vapour of chloride of copper may be employed for the same purpose. The coating of copper thus obtained may be converted to one of brass by exposing the sheet of metal to the vapour of zinc in a closed vessel.

Claims—1. The use of chloride of zinc, applied as described—in a previously fused state; also the use of chloride of zinc mixed with chloride of potassium or chloride of sodium, and of sulphate of zinc in mixture with chloride of potassium or chloride of sodium, in manner described.

2. The use of the alloys specified or referred to, and of the process described for coating metals with such alloys.

3. The use of a mixture of chloride of zinc and sal-ammoniac, which is kept in a state of fusion over the surface of the melted tin, or alloy of tin and lead, in effecting the deposition of these metals on the surface of other metals.

4. The process of coating iron or other metals with silver, or silver alloyed with copper, by amalgamating the surface of the metal to be coated, and then putting it into the melted silver or alloy.

5. The use of borosilicate of lead kept in a fluid state on the surface of the melted copper or brass, or alloy of copper with zinc, tin, or lead, used for coating iron by immersion.

6. The process of coating iron with copper by exposing the iron at a red heat to the action of fused chloride of copper or its vapour, and of subsequently converting the coating of copper to a coating of brass, by exposing the former to the action of vapors of zinc.

Improvements in the manufacture of starch and gums. SAMUEL HALL, late of Basford, near Nottingham, civil engineer. Patent dated January 11, 1851.

Claims—1. The use of chlorine alone, or in combination with water, but not combined with lime, for bleaching starch and rendering it white. Also, the use of sulphurous acid in its fluid or gaseous state, for the same purpose.

2. The use of chlorine for bleaching gums. Also the use of sulphurous acid in any suitable state for acting on gums with the exception of "all the varieties of gum arabic, including that brought from Senegal."

3. The combining or commixing of starch and gums in any proportions that may be necessary for the purposes to which they are applied, but which proportions, owing to the various qualities of starch and gums, and the variety of uses for which they are required, experience alone can determine. Also the use of alkaline, saccharine or saponaceous matters, or lime, or hydrate of lime, or lime-water, previous to, or during the evaporation or desiccation of gum or of starch and gums conjointly. Also, the evaporation or desiccation of starch and gums (inclusive of gum arabic), or the mixtures of both, by means of a vacuum, or under a pressure less than that of the atmosphere. Also, the process of the inspissation of gums by the evaporation of the water in which they are dissolved, in vacuo, independent of or combined with the process of bleaching, by means of chlorine or sulphurous acid.

Improvements in consuming smoke and in regulating the draught in chimneys. GEORE ANSTEY, of Brighton, gent. Patent dated January 11, 1851.

The improvements here claimed comprehend,

1. A method of consuming the carbonaceous inflammable matter contained in smoke, by causing it to pass through a series of apertures, and thereby retaining it longer in contact with the flame and heat of the fireplace or furnace to which such apparatus may be attached.

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2. A method of maintaining an equable temperature at the top of a chimney, by attaching thereto an appartus for preventing the two sudden ingress of wind.

Improvements in the construction of apparatus for manufacturing, and apparatus for retaining and drawing off soda water and other aërated liquors.—CHARLES COWPER, of Southampton Buildings, Chancery Lane. Patent dated January 16, 1851.

Claims—1. The construction of apparatus for manufacturing aërated waters, by placing within the generator an acid vessel furnished with a cock or valve, and so arranged that the valve may be opened and closed from the exterior.

2. The general arrangement of the apparatus, in which the generator is surmounted by the receiver, and inclosing the acid vessel and washing vessel—both the generator and receiver being furnished with agitators on horizontal axes.

3. The construction of the valves of bottles for retaining and drawing off aërated liquors by means of a disc of vulcanised caoutchouc or other suitable elastic material, whose edges enter a recess in a cap, and which is pressed against a rounded or flat edge, as described. Also, the construction of such valves of disc of vulcanised caoutchouc or other elastic material, contained in a cap so arranged as to confine the disc.

4. The application of a flexible metallic capsule for securing the valvular stoppers of bottles for containing aërated liquors, the junction being made good by cement, or by a ring or collar of vulcanised caoutchouc, or other elastic material.

5. The construction of the valvular stoppers of bottles for containing aërated liquors in such manner that they may embrace the neck of the bottle, and be compressed closely around it, the junction being made good, as in the former case, by cement, or by a ring or collar of vulcanised caoutchouc or other elastic material.

6. The application of a cap screw on the neck of the bottle for securing the valvular stopper of bottles for containing aërated liquors, the junction being made good by a ring of vulcanised caoutchouc, or other elastic material.

7. Constructing a stopper with a valve, and affixing the same to a bottle for containing aërated liquors by securing it into the neck of the bottle, the junction being made good by a ring of vulcanised caoutchouc, or other elastic material.

8. The application of a collar or tube of vulcanised caoutchouc as a spring to close the valve, and serving at the same time as a packing to prevent the escape of liquid round the stem of the vavular stopper.

9. The construction of the valvular stoppers for bottles for retaining and drawing off aërated liquids with the stem of the valve made hollow, and with perforations therein for the purpose of admitting air.

10. The construction of valvular stoppers for retaining and drawing off aërated liquors with a tube which acts as the spout, and by pressing down which the valve is opened.

11. A method of securing the capsules and stoppers of bottles for retaining and drawing off aërated liquors.

Improvements in furnaces applicable to the melting of metals for making brass, yellow metal, and other compound metals. GEORGE FREDERICK MUNTZ, junior. Patent dated January 18, 1851.

These improvements have for their object the prevention of the loss from volatilisation which occurs when melting and mixing metals (especially when zinc is employed) for the manufacture of brass and other similar compound metals, and consists in the adaptation to the melting furnaces of two additional dampers, one in the bridge of the furnace, to shut off communication between the fire and the metal; and the second between the melting-pot and the chimney. There is also an additional flue (provided with a damper) between the fire and the chimney, for carrying off the smoke and products of combustion when the bridge damper is closed. The mixing operation will be thus performed in a close chamber, and the loss from volatilisation much lessened, if not entirely prevented.

Claim.—The construction of furnaces for melting and mixing metals, for making brass and other compound metals, in which zinc forms a part, which will allow such metals when melted, and whilst being mixed, to be confined or nearly so from the air, by the furnace being converted into a close, or nearly close chamber; thereby preventing a great deal of the loss which occurred from volatilisation in mixing such metals in the furnaces in use previous to the date of this invention.

Improvements in the preparation of fuel. WILLIAM REES, of Pembrey, Carmarthenshire. Patent dated January 18, 1851.

The object of these improvements is to effect the consolidation of small coal, or of coal admixed with coke, into a compact

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mass without the aid of extraneous adhesive matter.

In carrying out his invention the patentee prefers to use bituminous coal reduced to small pieces and dried by a gentle heat, which he places in moulds, and submits to a low continuous heat, of such a nature as to effect the partial fusion of the coal without volatilising the gas contained therein. By these means blocks may be obtained of an even fracture, and the same specific gravity as the coal previous to the heating operation. When blocks of a very compact character are required, the moulds are submitted to and retained under compression during the heating process.

Claim.—The confining of coal or a mixture of coal and coke in moulds or vessels that are air-tight, or nearly so, and exposing the same to heat and pressure in manner described, thus retaining the gaseous constituents, and causing them to aid in the fusion and ultimate cohesion of the fuel into a compact mass.

Improvements in purifying or filtering oils or other liquids. JOHN LIENAU, junior, of Wharf Road, City Road, merchant. Patent dated January 18, 1851.

The object of these improvements is to produce an oil of a superior quality for lighting and lubricating purposes, and this is effected by the addition to the oil under treatment (whether animal, mineral or vegetable), of a sufficient quantity of creosote, or of the essential oils of cummin, aniseed, or rosemary, to produce fermentation, after which the oil is passed through a flannel filter (the action of an exhaust pump being employed to facilitate this part of the operation), and thereby obtained in a state of great purity.

III. PHARMACY, MATERIA MEDICA, THERAPEUTICS, &c.

SANITARY NOTES.

THE parliamentary session of 1851 has come to an end, and what has been done? Those interests which bear on the physical well-being of the people have been frequently neglected and thrown aside to make way for theoretical, and, in many cases, most questionable debates, which gave far more opportunity for the display of oratory, but which will probably soon be forgotten.

The great question of supplying a community of 2,360,000 persons with available water, was postponed until so late a period that the committee to whom the investigation of the subject was at last referred, could not complete the inquiry.—Indeed this question is as far from a settlement as ever. The attempt of the Home Office to amalgamate the existing Water Companies into one gigantic monopoly, and thus ensure the continuance of heavy rates and bad water, has failed:—the wild scheme of the Board of Health, and its wilder "emendation" by Mr. Napier, are sent to the winds; and the only positive result yet arrived at, the assertion by the Government chemists in a solemn report, that hard water is far better than soft.

After many months of supposed investigation and consultation, the Commissioners of Sewers in London appointed a chief engineer, with a salary of £1,500 per annum. He forthwith produced a scheme for the complete drainage of the metropolis south of the river; the plan was approved and contracts were taken. After a due interval, a scheme for the drainage of the metropolis north of the river was made by the same officer, and accepted by his masters with songs of praise for his indomitable energy and perseverance, as he actually used to be at his office by 10 A.M. when engaged on these plans. Undeserved praise is the bitterest censure. Both plans have been proved to be insufficient and impracticable, and are either actually or about to be abandoned. The House of Commons Water Committee have made the important discovery that there is a connection between the facts of putting water into a house, and of taking it away again; and, upon that hint, the two questions are "postponed for full investigation next year."

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In the mean time, as the twelve first-rate men who constitute the Commissioners of Sewers could seldom contribute six of their number to make a necessary quorum, a temporary Act has been passed this Parliament to commit all the sewering operations of this gigantic city to the absolute control of *one* man. The bill makes two a quorum, but appoints a chairman, with a salary of £1,000, and a casting vote; he is therefore supreme, at least if he can induce one dummy to attend and help to register his acts.

It is true that the window-tax is gone; and the duties on timber have been reduced; but there is no relief in London from the iniquities of the Building Act. A new bill had been hatching for two years, but when its shell was broken, it was found to be so misshapen that it was necessarily destroyed.

The Board of Health have obtained four Acts for extending their sway over a further list of towns, under the Health of Towns Act. It is, however, very questionable how far this Act is properly named, as it is being executed; for the filth, instead of passing into the earth, as much of it has hitherto done, is now all brought to one place and discharged into brooks or rivers, where it undergoes a vicious decomposition, and generates malaria, besides destroying the water for all useful purposes.

Reference has been made in former papers to the now well-known properties of peat-charcoal in absorbing and fixing volatile gases. It is really too bad that public Boards and public men will always shut their eyes to practicable improvements which are not of their own device. A Chief Sanitary Board lays it down as law to all the local Sanitary Boards, that they shall bring all that is offensive in their district to one spot, and there pour it out, that the rays of the mid-day sun may develope those horrid steams, which the midnight dews shall bring down with deadly sting about the sleeping inhabitants. And yet there exists a material, which is otherwise nearly useless, and which is of most simple manufacture, by which every offensive gas that is produced from decaying animal or vegetable matter can be retained, and indeed fixed, by simply passing in contact with it, without the possibility of again injuring the most fragile life that exists on the food of a pure air. It is quite certain that sanitary legislation must be carried on upon an improved system, or altogether be abandoned. But the people themselves must see to it.

Lord Shaftesbury has carried two Acts through Parliament, of that practicable and useful tendency which has distinguished the majority of his actions. One is, to encourage the building of lodging-houses; the other, for the better regulation of common lodging-houses. By the latter Act there is hope that those dens of crime, misery and pestilence will be brought into a better state; they must now be registered and be under police superintendence, with limitations as to the number allowed to congregate in them.

The House of Lords have also intimated that whenever Bills are brought before them for carrying improved streets through bad neighbourhoods, they will insist upon proper provisions being inserted to secure accommodation for the poor who may be turned out of their homes. By such means, the horrible evils which result at present from carrying fine new streets through "bad properties" by the crowding of the poor into even narrower spaces than they previously occupied, will be remedied; and in this way towns may be really improved.

It is sincerely to be hoped that after this season of unexampled locomotion, when the population of the country has been circulating in all directions to an extent previously unknown, a vegetation of ideas and powers of observation and reasoning may spring up in many soils which have hitherto been barren and unimprovable, and that everywhere the action of the natural laws which affect health and life may be noted and understood. During the last five years the knowledge of sanitary requirements has vastly increased; but a

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great extension of this knowledge, as well as prompt action in realising it, are still required before it can be said that in these kingdoms a real sanitary system is in force.

EXPERIMENTAL RESEARCHES ON THE MODIFICATIONS CAUSED IN THE ANIMAL TEMPERATURE BY THE INTRODUCTION INTO THE ECONOMY OF VARIOUS THERAPEUTICAL AGENTS.*

BY MM. AUGUSTE DUMERIL, DEMARQUAY AND LECOINTE.

OPIATES. — Amongst the preparations of opium, we have chosen Rousseau's laudanum, acetate of morphine and codeine.

Nine experiments have been made with these substances: we have introduced them into the stomach or veins, and the final result has always been a lowering of the temperature, sometimes considerable, and, in certain circumstances, it is produced with great rapidity.

Acetate of morphine has been used four times; twice it was put into the stomach and twice into the current of the veinous circulation. In the first mode of experimenting, the doses were from 0·20gr. to 0·30gr. in 120 grammes of water, at 95° F., and caused a notable diminution of the heat proper to animals; it went as far as 3° C., (5°·4 F.), in each experiment. One dog died the next day, the other recovered. One remarkable circumstance is the rapidity with which the effects on calorification are produced. Thus the medicine had scarcely been introduced into the stomach for an hour when the thermometer had fallen 2°·9 C., (5°.2 F.) in one case, and in the other 2°·3 C. (4°·1 F.).

Comparatively with these results, two experiments were made with 0·05gr. and 0·12 gr. which were injected into one of the crural veins mixed with 60 grammes of water at 95° F. With 0·05 gr. we noticed a diminution of 3° C., (5°·4 F.), and of 5° C., (9° F.) with 0·12gr. It is important to mention that the animals only died the next day in the morning, from twenty-four to twenty-eight hours after the commencement of the experiment. As for the time which elapsed between the moment when the injection took place and that when the depression of the temperature manifested itself, it was proved to be very short; for with 0·12gr. the animal had lost 1° C. (1°·8 F.), of heat in eighteen minutes, and 3°·2 C. (5°·76 F.) in forty-two minutes, its temperature having fallen from 39°·7 C., (71°·46 F.,) to 36°·5 C. (61°·3 F.) It was observed, besides, that 0·05gr. sufficed to lower the thermometer 1°·7 C., (3°.06 F.), in twenty-five minutes, and 2°·6 C. (4°·68 F.) in fifty-five minutes. The depression continued afterwards, but more slowly.

This fact, then, brings another element of support to the conclusions drawn by Hunter and by different observers, and more particularly by M. Magendie, from the experiments which they instituted to demonstrate the often surprising rapidity of absorption. But the chief observation which results from most of our experiments and more especially from these last, where acetate of morphine has penetrated into the economy by the veinous circulation, is relative to this fact, that the substance of which we treat exerted so powerful an action on the powers of life that the temperature of the animal, that palpable "evident" manifestation of the normal play of the organs, was perceptibly modified in a very short time.

Cyanide of potassium, as we shall see hereafter, acts even more rapidly.

Codeine, one of the least energetic elements of opium, was given twice: the first by the stomach in the dose of 0·20gr. There was as first a slight lowering perfectly in character with the peculiar action of narcotics; but this action was soon overcome by the vital reaction, and there was then a slight elevation, which at the end of eleven hours had not exceeded 1° C., (1°·8 F.) The second time, 0·10gr. was injected into the veins, and the action of the codeine was perfectly similar in this mode of experimenting to what it was in the preceding experiment, but the effects were infinitely more energetic. In forty-five minutes, in fact, the thermometer fell 3° C., (5°·4 F.), then the vital reaction soon manifesting itself, the temperature in eleven hours had nearly returned to its original point. The animal soon recovered this serious but momentary disturbance of its calorification.

Three experiments were made with *Rousseau's laudanum*. Twice it was injected into the stomach in the dose of 4 grammes and once in the dose of 8 grammes. With 4 grammes in one case and with 8 grammes we obtained 2° C., (3°·6 F.) of cooling. In the second experiment, with 4 grammes, contrary to the preceding results, the temperature remained stationary at first, rose 0°·4 C., (0°·72 F.) at the end of two hours, and this elevation continuing, it had reached 1° C., (1°·8 F.) at the fifth hour.

If then, we set on one side this exceptional

* *Comptes Rendus*, No. 26, June 30, 1851.

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case, the explanation of which might perhaps be attributed, either to the presence in the stomach of some alimentary matters which might have annulled the effect of the medicament, or to its complex composition, we find that the habitual result of preparations of opium consists in an abatement of the temperature. In none of our preceding experiments had it been so considerable, nor above all so prompt.

Among the therapeutic agents called narcotics furnished by the family of solanaceæ, we chose belladonna, tobacco, datura stramonium, and hyosciamus.

Extract of belladonna.—Three experiments have been tried with 0·20gr, 4 and 12 grammes, and have produced a lowering of temperature. It varied from 0°.2 C. (0°·36 F.), to 1°·3 C. (2°·34 F.), and this latter limit was only attained with 12 grammes, an enormous dose if we consider the ordinary poisonous effects of this substance which, without causing any very considerable disturbance in the play of the organs, nevertheless occasioned death in thirty-six to forty hours.

With this fact and some others which we intend submitting to a further comparative examination, is connected the important question whether the perturbations in the normal exercise of the functions are always connected with modifications in the temperature, or if, on the contrary, they are independent of them.

Atropine—This active principle of the belladonna was introduced once into the stomach in the dose of 0·25gr. in 30 grammes of water at 95° F. It caused a lowering in the temperature of 0°.5 C. (0°·9 F.) in the first hour, but the temperature soon rose again, and at the end of ten hours it had risen as much above its orginal point,

But if its effects are but little remarkable in this mode of experimenting, their energy is very different when mixed directly with the substance of the blood. The dose injected was twice 0·20gr. and once 0·19gr. In one experiment twenty minutes, and in the other forty minutes had scarcely expired when a depression of 2° C. (3°·6 F.) manifested itself. The third dog, although it had received by the introduction of this poisonous agent, a violent disturbance, since it died in the night following the day of the experiment, did not present the same phenomena. The coldness did not commence until the fourth hour, and only after an elevation of 0°·6 C. (1°·08 F.), but at the close of ten hours it had attained 3° C. (5°·4 F.)

Tobacco.—8 and 15 grammes of the leaves in decoction occasioned some oscillations in the temperature, of which the result was an augmentation of 0°·6 C. (1°·08 F.) in one case, and of 1°·6 C. (2°·88 F.) in another.

Alcoholic extract of the seeds of datura stramonium.—Experimented with in the doses of 1 and 4 grammes, it lowered the temperature 0°·8 C. (1°·44 F.) in one hour with the weakest dose, and it was five hours before the temperature returned to its original figure. The depression, in the second case was 1°·4 C. (2°·52 F.), it was maintained for more than three hours, and had not completely ceased five hours after the commencement of the experiment. In a third case, 1 gramme on the contrary produced a slight elevation from the first, and 1°·3 C. (2°·34 F.) was noticed at the end of five hours.

Extract of hyosciamus.—The effects obtained were not very distinct. In two experiments with 10 and 30 grammes, there was at first a slight depression, then a slight increase. A clear elevation of 0°·8 C. (1°·44 F.) was from the first shown with 2 grammes; it only occurred, on the contrary, at the close of four hours, with 15 grammes.

To sum up, if we except tobacco, with which the experiments were not sufficiently numerous, nor, consequently, sufficiently conclusive, and hyosciamus, the definite effect of which appears to be exciting the function of calorification, the principal medicaments of the family of solanaceæ act upon this function in the same manner as the opiates, but with less energy. The disturbance which they occasion in the economy and, in particular, in the functions of the nervous system, are however very manifest. Would the difference in the intensity of their action, as modifiers of the animal temperature, continue if their influence were exerted on other points of the nervous system than those affected by opium and its principles? And if, as an hypothesis, the production and persistance of heat depend on certain parts of this system rather than on others, might we not find in this supposition an explanation of the difference of which we speak?

Cyanide of potassium.—Eight experiments have been tried: in five of them the medicament was given in doses which would not be poisonous to animals, and yet sufficiently powerful to produce serious disorder in the economy, and especially stupefaction. They were three times 0·01gr. and twice 0·025gr. With 0·01gr. we obtained at first a trifling diminution, which, in one case continued during more than two hours, and soon, the vital reaction carrying it off, the

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thermometer rose again and returned to its original point and even passed it by 1°·4 C. (2°·52 F.) or 2°·7 C. (4°·86 F.)

0·025gr produced a prolonged diminution of 1° C. (1°·8 F.) in one case, and 1°·8 C. (3°·24 F.) in another; it was only at the end of four and of seven hours that the temperature rose again.

Death, preceded by convulsive movements, was very soon produced by putting into the stomach 5, 25 and 50 centigrammes of this powerful medicament; but in this short space of time there appeared a considerable disturbence of the calorification which, lowered from the first instant, suffered a continual abatement. Under the influence of 0·05gr. life continued for thirty-three minutes, and the loss of caloric was 1°·9 C. (3°·42 F.); the fall was only of 1° C. (1°·8 F.) with 0·25gr., but the animal resisted death for a few minutes less; and, finally, under the influence of 0·50gr. the animal sunk still more quickly after a diminution of 1° C. (1°·8 F.)

Thus cyanide of potassium diminishes the temperature. As with all other substances, the lowering action is overcome by the vital reaction with small doses, and the temperature rises. In larger quantities the lowering action continues until death. Sometimes an effort of nature may be observed which will go as far as 0°·3 C. (0°·54 F.); but it is in vain: the dynamic action or poisonous agent has the victory and the animal sinks.

ON THE EMPLOYMENT OF TARTRATE OF SODA AS A PURGATIVE.*

BY DR. DELIOUX, PROFESSOR TO THE NAVAL SCHOOL OF MEDICINE, ROCHFORT.

(Report of MM. Bouchardat and Bricheteau).

SINCE M. Laroque published his observations on the employment of purgatives in typhoid fever, the purgative neutral salts have been much more employed than they were twenty years ago. At first, the preference was given almost exclusively to Seidlitz water. Several considerations combine to recommend this medicine: such as its low price; its perfect innocuity (fresh-water animals can live in a solution containing $\frac{1}{25}$ of sulphate of magnesia); the facility with which the taste of the solution of this salt can be disguised by charging it with from 3 to 5 volumes of carbonic acid. However, this solution, although a little modified by the presence of carbonic acid gas, is still very disagreeable to many people: when the employment of Seidlitz water is continued for several days following, the stools become very fetid, partly owing to the presence of sulphuret of magnesium, resulting from the conversion of a portion of the sulphate of magnesia into sulphuret under the influence of the organic matters contained in the intestines.

The following are the reasons which have led to the search for saline purgatives which would have the advantage of the sulphate of magnesia without its inconveniences.

The salt of Seignette, or tartrate of potassa and soda, is a neutral salt which, in many respects deserves attention. By augmenting the dose one-third, it purges as well as the sulphate of magnesia; its taste is freshly saline and easily disguised; it does not furnish any fetid or injurious product by decomposition in the digestive apparatus; notwithstanding these great advantages, it has not maintained the rank which it occupied for many years in therapeutics.

Phosphate of soda is also an excellent purgative neutral salt possessing all the advantages of the salt of Seignette. However, it has scarcely ever been employed in Paris, to our knowledge, in a continuous manner, except by M. Begin.

The remarkable report of M. Soubeiran sufficed for gaining credit for M. Rogè's lemonade of citrate of magnesia, a minorative purgative commendable for its agreeable taste and innocuity.

Attention being attracted in this direction, neutral salts analogous to citrate of magnesia have been sought, which, like it, would purge *cito, tutô et gucundè*. M. Felix Desvigue, of Algiers, thought of the tartrate of soda, and he sent to me on the 10th of November, 1850, at the same time as to our colleague, M. Chevallier, the following formula for a purgative lemonade of tartrate of soda:—

℞ Bicarbonate of soda	} of each ..	grammes. 35
Crystallised tartaric acid		
Spring water		450
Simple syrup		50
Tincture of citron peel, 10 drops.		

F.S.A. a solution.

A few minutes suffice for operating the conversion of the bicarbonate of soda into tartrate of soda. The operation is completed when the mixture, disengaging no more carbonic acid, has become clear and limpid. The syrup and the aromatic tincture are then added, and, thus prepared, we obtain

* *Bulletin del l'Académie de Médicine.*

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a very purgative lemonade, having an agreeable taste; if it be desired to have this lemonade gaseous, 4 or 5 grammes of bicarbonate of soda are kept and added to the lemonade just before corking the bottle.

According to the proportions indicated, the solution represents 50 grammes of purgative salt. This dose, being intended for persons of strong constitution, may be reduced according to the temperament of the patient.

Dr. Delioux has employed Dr. Desvigne's lemonade with success, but he has thought, and rightly, that it was preferable to employ the tartrate of soda, which may be used in all kinds of pharmacological association.

This salt is of easy preparation and may be perfectly kept. It has very little taste, which may be entirely covered by the addition of syrup of lemon, raspberry, orange flower, &c., or with sugar rubbed on the fresh peel of orange or citron.

The purgative action of tartrate of soda leaves nothing to be desired: it seems equal to that of the sulphate of soda and magnesia, and it appears superior to that of citrate of magnesia. It purges promptly, and without colic, in the average dose of 40 grammes.

As a therapeutical agent, says M. Delioux, the tartrate of soda has no more therapeutical value than the most commonly-employed neutral salts. Only, since lately a neutral salt free from all disagreeable taste has been much sought for, it is not uninteresting to notice the tartrate of soda, which unites with the most manifest purgative properties the advantages of being able to form a solution whose taste can be repugnant to no patient, of being very cheap, and even cheaper than the magnesian compounds, of being adapted by its base to the dominant constitution of animal humors, and of being thus susceptible of being administered in large doses without fear of serious accidents. It possesses, in a word, all the advantages of the salts of soda.

MM. Bouchardat and Bricheteau administered the tartrate of soda as a purgative, and have verified the facts announced by Dr. Delioux. The following is the result of observations, collected by M. I. Fairet, assistant to M. Bricheteau, St. Ferdinand's ward.

1. No. 23. Epileptic, took Seidlitz water over night, and had only one stool; 19th June, 45 grammes of tartrate of soda, three stools.

2. No. 6. Slight typhoïd fever, on the seventh day, purged once with Seidlitz water; 22nd June, 45 grammes of tartrate of soda, fifteen stools.

3. No. 5. Epilepsy. 24th June, 45 grammes of tartrate of soda, ten stools.

4. No. 12. Slight typhoïd fever. 24th June, 45 grammes of tartrate of soda, five stools.

5. No 7. Pleuretic effusion, 26th June, 35 grammes of tartrate of soda, three stools.

6. No. 8. Intense angina. 29th June, 40 grammes of tartrate of soda; about fifteen stools.

7. No. 43. Slight typhoïd fever, 29th June, 40 grammes, four stools.

8. No. 7. Pleuretic relaxation. 30th June, 45 grammes, three stools.

9. No. 9. Slight typhoïd fever, with effusion. 30th July, 40 grammes of tartrate of soda, about twelve stools.

10. No. 15. Slight typhoïd fever, with a little relaxation; 5th July, 45 grammes of tartrate of soda, about ten or twelve stools.

11. No. 48. Hypochondriac tympanitis; having taken a purgative lavement two days before; 5th July, 45 grammes of tartrate of soda, two stools.

12. No. 9. Typhoïd fever on the fifteenth day; relaxation, 35 grammes of tartrate: about fifteen stools; the patient said he could not say how many times, he had been so frequently to the water-closet.

It is evident that purgation by tartrate of soda, in the dose of 40 grammes, is, as Dr. Delioux has stated, sure and agreeable.

The Academy cannot too much encourage well-followed up and faithful studies of the properties of medicines. Professor Delioux has already addressed to the Academy several useful works of this kind; we may mention more particularly an extensive work on emollient treatment, and a memoir on ipecachuana employed as a counter stimulant. We have therefore the honor to recommend you:—

1. To thank Dr. Delioux for his interesting communications;

2. To send his memoir to the committee of publication;

3. To add his name to the list of candidates for the rank of correspondent.

POISONING BY SULPHATE OF ZINC.*

BY M. BROEKX.

M. P—— aged fifty of a good constitution, thought he required a purgative; he therefore procured an ounce of Epsom Salts which he resolved to take next morning. On the 8th April last, about seven in the

* *Annales de la Société de médicine d'Anvers.*

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morning, he took from a drawer a white powder, and asked his servants if it were the purgative powder which he sought, because in consequence of myopia, he could not be certain. His servant replying in the affirmative, M. P—— mixed the powder in a cup of coffee and swallowed it at one draught. Immediately he complained of a sensation of constriction at the back of the throat and asked for water to drink, a quarter of an hour after he felt a weight and tightness in the epigastric region, followed by cramps and fainting: with great difficulty he reached the open air and drank large quantities of cold water. The pains in the stomach increased in intensity until they resulted in abundant vomitings of a yellowish matter; the pain was so great and the vomitings so abundant that the patient fell down. They carried him to bed and then the following symptoms were observable: cramps in the stomach and intestines, reaching even to the inferior members, precordial anxiety, frequent vomitings, abundant stools, pallor and icy coldness over the whole body, the eyes surrounded by a blueish circle, and sunk in their orbits. Pulse imperceptible, the beatings of the heart weak and slow; suppression of the urinary secretion, notwithstanding the enormous quantity of water which the patient swallowed; intense thirst; the voice low and sepulchral, similar to that of cholera patients in the third stage.

At my arrival about an hour after the beginning of this attack, all these symptoms continued, but with less intensity. When I saw this alarming state of things my first care was to enquire into the cause. The reply was that the patient had taken *eramilstein* by mistake instead of the English purgative salt. As I was not aware that this was, in our town the name vulgarly given to sulphate of zinc, M. Verbuecken, a pharmaceutist, told me that the patient had taken nearly two ounces of this substance. I could not avoid asking for what purpose they used so active a remedy, and why was it left without care and within reach of almost every one in the house. I then learned a fact hitherto unknown to me: M. P—— followed in the path of *Lubin*, *Kervyn* and *Nicolai*. In fact sulphate of zinc, dissolved in water, was distributed to all comers gratuitously as an infallible cure of complaints of the eyes. They gave me a history of all the wonderful cures worked by this *collyrium unknown* in medicine!!

After having shown them, in a few words, all the illegality and dangers of this manner of acting, since the master of the house, who appeared to me the most intelligent and prudent, had become a victim to it, I examined the sick man. The following was the list of symptoms which I found. The body was still cold, the hands blueish, stiff as in cholera; cramps of the stomach and inferior members, the eyes with a dark rim round them, dull and without expression; the pulse at 32 pulsations per minute; tongue red, thirst intense, tightness at the throat, low voice, continual vomitings, stools and faintness.

There appeared to me to be three things necessary: 1st, to evacuate the poison swallowed; 2nd, to neutralise its effects on the economy; 3rd, to reanimate the almost extinct vitality.

The first was already in great part done; I caused it to continue by giving tepid water. As sulphate of zinc is soluble in water, drinking this liquid contributes to neutralise the effect of the poison on the economy. To fulfil the third indication I caused the application of hot linseed meal cataplasms to the stomach and sinapisms to the calves of the legs.

About ten o'clock in the morning I returned to the patient whom I found in the following state: the cramps, vomitings and alvine evacuations had diminished: the skin was warm and moist, the pulse had risen to 50 pulsations; the patient only complained of extreme weakness. The urinary secretion had not reappeared. *Prescription;* gum mixture and continuation of the other means.

About eight in the evening, M. P—— was in a good perspiration and said he was cured. He had not micturated until about seven o'clock, notwithstanding the enormous quantities of water that he had taken. I regarded this excretion as critical and I caused him to continue the same remedies, the sinapisms excepted. The next day, 9th April, M. P—— attended to his business, although he still complained of a sensation of weakness.

Reflections. This case supports the fact, already mentioned by toxicologists, that, of all the poisons, sulphate of zinc produces the fewest serious accidents, being speedily evacuated in consequence of its vomitive property. Therefore the treatment of poisoning by sulphate of zinc may, in the majority of cases be confined to giving the patient a great quantity of tepid water. We may also have recourse to milk or albuminous water should these liquids be at hand, not only because they aid the vomiting, but likewise because they have the faculty of chemically decomposing sulphate of zinc. In this respect milk and white of egg offer the advantage of being in themselves per-

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fectly harmless, whereas the alkaline solutions which precipitate oxide of zinc from its soluble salts, are always more or less irritating. As for the treatment necessary to combat the general symptoms of the poisoning, the preceding case seems to shew that bleeding would not be suitable, contrary to what would appear at first sight, for the purpose of combating the gastro-intestinal irritation. Sanguinary depletion, on the contrary would only have an injurious effect and would have infallibly augmented the state of vital prostration in which the patient was plunged, and this prostration is, undoubtedly, the symptom which most endangers life. Thus it is necessary whilst giving diluent drinks, to employ at the same time external remedies capable of rousing the vital functions from their torpor by stimulating the system of cutaneous capillary vessels. For this purpose I had recourse to sinapisms and hot cataplasms. This treatment appeared to me in all respects rational: sulphate of zinc acts on the animal economy not only by irritating the coats of the digestive tube, but likewise by attacking, in the same manner as many other metallic poisons, the principle at its source, in other terms, by lowering the vitality.

PRESERVATIVE LIQUID AGAINST SYPHILLIS.*

BY M. LANGLEBERT.

AFTER several fruitless attempts, says M. Langlebert, I made three successful experiments at the end of last month, with a liquid, of which I give the formula below. I was almost convinced of the success of my discovery, when one of my pupils, M. R** to whom I had spoken of it, proposed to me to subject himself to a decisive proof.

Last Monday, 14th July, I took some pus from the surface of a phadendic chancre, with an indurated base, and I immediately inoculated with it the left thigh of M. R**, then steeping my lancet again in the same pus, I scratched the right thigh in such a manner as to remove from a small piece the epidermis and a portion of the dermis. This done, wishing for my own conviction, to put every unfavorable chance in the way of my process, I steeped the lancet again and again in the virulent pus, which I put, all hot, all alive, as may be said, layer on layer in the wound which I had made. I then waited five or six minutes, and I applied my preservative.

The next day, the pus inoculated into the left thigh had produced its usual effect, whereas the right thigh presented only a small dry crust, covering the wound. M. Cullerier and M. Ricord saw this result.

On the third day, the pustule on the left thigh was cauterised with mono-hydrated nitric acid.

Last Friday M. Langlebert made a public experiment on MM. Albanel and Moreau, two of his pupils, who spontaneously asked it of him, and on himself, and obtained the same success.

The following is the formula of the preservative liquid :—

	grammes.
Alcohol at 36°	40
Soft potassa soap, with an excess of base	40

Dissolve and filter; then add :

Essential oil of citron	20

This liquid is not caustic : when put upon the mucous membrane it causes a slight sensation of heat ; the application should continue for two minutes, after which wash in cold water.

* *Union Médicale.*

POISONING BY CHLORIDE OF BARIUM.*

BY DR. C. WOLF.

A STUDENT of medicine, who supposed that he had swallowed three teaspoonfuls of sulphate of magnesia, was seized with tormina and vomiting ; the pulse was weak and irregular; the tongue natural. Dr. Wolf at first supposed the case to be one of "summer cholera," excited by the purgative ; but as in half an hour more he found his patient with ice-cold extremities ; pulse 65, irregular and feeble ; hands and feet powerless ; paralysis of the left eyelid; the voice weak, and incessant griping—he analysed what remained of the so-called sulphate of magnesia, and found it to be chloride of barium. The patient took only some sulphuric acid and castor oil, by which the griping was soon removed, but there came on retention of urine requiring the catheter. The muscular powerlessness soon disappeared, and in three days the patient was quite well. He had taken altogether three drachms of the salt. Dr. Wolf detected the chloride of barium in the evacuations by incinerrating them.

* *Casper's Wochenscrift, in Schmidt's Jarbücher*, No. 1, 1851.

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BATH OF TURPENTINE VAPOR IN RHEUMATISM.*

BY M. A. CHEVANDIER.

EVERY one is aware that essence of turpentine has been for many years frequently used in medicine as a remedy for rheumatic pains. It was at first prescribed internally; its external use is more recent. Every body has had more or less reason to be pleased with its effect in such cases.

The rheumatic subjects of our mountains certainly knew nothing of all this when they came to plunge themselves into the pitch ovens. The high temperature which they expect to find cause them to hope for an abundant perspiration which would lead to a quick termination to their pains. It is therefore to baths of turpentine vapor that they are indebted for the radical cures which they are in such haste to proclaim. And before proceeding further I think it right to say a word as to the mode used in our country for extracting the black pitch from the Alpine pines which cover some of our mountains.

In other localities it is extracted from the remains proceeding from the making of turpentine and galipot, by placing them with chips of fir wood in an oven heated on the top. Here, they do not collect the turpentine previously, so that the chips contain all their essential oil. The manner of collecting the black pitch is the same as elsewhere; as soon as the first batch is done, all the openings of the oven are hermetically closed, so as to keep up a sufficiently raised temperature to drive out all the resin contained in the wood which will be put into it the next day, without the necessity of adding more fire. In fact, the next day fresh layers of chips are arranged at the bottom of the oven, and it is then that the patients are plunged into this atmosphere saturated with turpentine vapor and at temperature of about 86° F. They should be dressed in clothes which they will not require to wear again; those who fear suffocation take a handkerchief steeped in water, to freshen the air.

According to the power of endurance of each the patients remain from five to twenty minutes in this really infernal temperature. As soon as they express a wish to that effect, they are removed from it, and immediately put into a bed; a very abundant perspiration is soon produced. Two or three of these baths are sometimes sufficient to cause a lasting cure of a long standing and severe pain.

The patients have told us that they experienced the following symptoms during their immersion: great heat is produced on the skin; they seem to be in imminent danger of suffocation; the head becomes congested; the pulse rises, the movements of the heart are accelerated. None have complained of heat in the throat or of cough. None have been indisposed to take a second bath, so much has the first soothed his pains and given liberty to his almost anchylosed members.

* *Revue médico-chirurgigne.*

POISONING BY SCHEELE'S GREEN.*

BY THOMAS STEWART TRAILL, M.D., PROFESSOR OF MEDICAL JURISPRUDENCE IN THE UNIVERSITY OF EDINBURGH.

IT is well known that various substances capable of acting as poisons are in common use as pigments, and especially that a very beautiful green is obtained from the arsenite of copper, which is commonly known as *Scheel's Green*. An instance of the deleterious effects of this substance occurred here on the 31st of May.

George Webster Graham, a child of three years of age, had obtained some slips of paper colored with this material, and had chewed some of it. He returned home, complaining of severe pain over his abdomen and vomited repeatedly. His mother observed some shreds of the paper in his hands, and saw some of the green matter on his lips and cheeks. The vomiting returned at intervals with severity, the pain was violent, and I was sent for; but I did not return home for three hours after he was taken ill. In the meantime, his pulse became feeble, his extremities cold, and face livid. I went immediately on coming home, and found the vomiting had somewhat abated, and that the skin was recovering its heat; but the pain in the bowels was still acute. On hearing the symptoms, I enquired if the child had swallowed anything unusual, heard the story, and on seeing the piece of paper, immediately concluded that it was colored by arsenite of copper, and had caused the child's illness.

I instantly gave the only remedies at hand,—magnesia in milk, with the whites of two eggs diffused in water,—until I could procure the more powerful antidote, the *hydrated peroxide of iron*. I also directed small portions of milk porridge to be repeatedly given. All the symptoms were so

* *Monthly Journal of Medical Science*, July, 1851.

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relieved before the peroxide was procured, that I judged it unnecessary to administer that antidote; and next morning the boy was quite convalescent.

On the third day the child passed by stool one or two fragments of the paper, on which some of the green color was still visible; and for a few days more he did not take his food with his usual relish; but no other bad consequence has followed.

I preserved the shreds of paper which the child had carried home, scraped off a portion of the green color, mixed it with a little soda flux, and subjected it to heat in a tube; when I obtained a distinct metallic crust, with a crystalline inner surface, an alliaceous smell, and resolvable, by heat and air, into white crystals, with triangular facets, proving the coloring matter to contain arsenic, of which the quantity appears much more considerable than I expected. On comparing the pigment on the paper with Syme's Wernerian colors, it answers to pale *emerald green* (No. 52).

It seems improper to employ so dangerous a material as *arsenite of copper*, in such large quantity, on articles like paper-hangings, which may often come in the way of children, or other persons little aware of the deleterious properties of this coloring matter.

POISONING BY SULPHATE OF IRON.*

BY M. P. LIMOUSIN-LAMOTHE, OF SAINT AFFRIQUE.

A MAN, named Matet, returned home on Thursday evening, carrying a faggot of wood; after this his wife shut the door of the house, and did not open it to any one in spite of the inquiries of the neighbours, who were attracted by sounds of groaning. On the Saturday morning, before daylight, the woman called for help; the neighbours came, and found Matet dead in his bed. As the domestic relations of the couple, and the character of the woman, were of bad repute, the authorities were informed, and repaired to the place with the scientific men who were called in. The latter than learned that the woman had, previously to their arrival, and even during the night, washed a large quantity of linen; and that, according to the wife's statement, Matet had complained of a pain in his side, after which he had died. On dissection, beyond some slight lesions of the alimentary canal, there were found some adhesions of the pleura, and softening of a part of the lung. The ordinary organs for chemical analysis were taken away, and along with them some patches of the bed cover, stained with fœcal matters, and the authorities handed over to them a bottle containing about two wineglassfuls of water, with some bread, a pint bottle of wine, and a packet containing a white powder. Some days after, the author, along with Dr. Ancessy, made a chemical analysis, of which the following are the more important results:—

1st. Arsenic sought in the liver. No result.

2nd. A fourth part of the stomach was carbonised by sulphuric acid, the carbonaceous residue treated with nitric acid to oxodise any metals it may contain. The nitric acid driven off, and the residue taken up in water. A fourth part of this was treated by Marsh's method, without any result.

The remainder of the liquid was subjected to various reagents, and gave the following results:—Sulphuretted hydrogen at first produced no effect; but the operators, thinking that some sulphuric or nitric acid might be present and interfering with the action, a few drops of ammonia were added to neutralise it; this at once produced a copious black precipitate, which was washed and collected. To determine whether this was due to copper, lead, silver or iron, a portion of the liquid was tested with prussiate of potassa, and gave an abundant precipitate. Gallic acid, which from the presence of free acid, would not act at first, gave a deep brown color on the addition of ammonia. Ammonia and carbonate of soda gave the characteristic precipitate [of oxide of iron]. Copper, lead and silver were sought for without results.

An important question now arose. Could these precipitates be due to normal iron of the blood contained in the vessels of the organs which were engorged, or were they due to iron swallowed during life? The amount of the precipitates left little doubt that they could not be due to normal iron, their united weight being in fact fifteen grains from about an eighth part of the stomach, and the portions of the small intestines which they possessed. The author, therefore, proposed to seek for the iron in other articles, and to determine the state of combination in which it had originally existed.

3rd. In order to obtain more precise ideas as to the origin and amount of the iron which they had found, they treated a portion of the lung with nitric acid. The residue was lixiviated with distilled water and concentrated. In this fluid hydrosulphuret of

* *Annales d'Hygiène*, January, 1851.

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ammonia and gallic acid only produced a deepening of the color, and ferrocyanate of potassa also only deepened the same. In an hour there were slight deposits from these reagents, which were only a little more apparent and appreciable next day; yet the lungs were obviously more charged with blood than the stomach and intestines. By way of comparison, 1500 grains of human blood were treated as above, and gave still fainter results with the reagents.

4th. One half of the pieces of bed cover which were stained with fœcal matters, were treated with boiling distilled water and filtered. The filtrate passed with great difficulty, and gave very little result with the various reagents. Presuming that the iron might exist in the state of protoxide, or in the form of an insoluble sulphuret, and had remained upon the filter, the portion which had not passed through was acted on by nitric acid. In this fluid, the presence of iron was abundantly shown by prussiate of potassa, hydrosulphuret of ammonia, &c. In these fœcal matters there could be no reason to suspect that the iron existed normally; they therefore concluded that it had been swallowed during life. But in what state of combination? This remained to be ascertained.

Sulphuric acid could not be tested for in the liquids from the stomach, because it had been carbonised by sulphuric acid. They therefore sought it in the liquid from the fœcal matters, and it was found in small quantity by the action of chloride of barium; but it still remained to be determined, whether the sulphuric acid might not come from other sources than sulphate of iron.

At this stage of the proceedings, the authorities brought to them a bottle containing vomitings of the deceased, which had been found under his bed. This bottle contained 2½ ounces of a thick paste. If sulphate of iron had been swallowed during life, it ought to be found in the undigested matter.

5th. One-half of the vomitings was taken; they consisted chiefly of bread in the form of a thick pulp, with fatty matters, a piece of bacon, &c. The viscosity of the mass prevented its being treated simply with water; it was, therefore, carbonised by nitric acid, and treated like the other matters. The product of the filtration was divided into two parts, in one of which iron was detected with equal readiness as in the other operations; in the other, sulphuric acid was detected in notable quantity by means of nitrate of baryta. All their doubts were now resolved, but a comparative trial for sulphuric acid was made with ordinary bread, which gave no results.

6th. The clear bouillie used for making a tisane [we presume this means the two wineglassfuls of water with bread found in the bottle] was tested, and sulphate of iron detected in it.

The little packet of white powder was found to be flour: the bottle of wine contained nothing unusual.

From all the facts detailed above, they drew the following conclusions:—

The stomach and intestines contained sulphate of iron.

This salt could not be derived, at least the whole of it, from normal iron contained in the blood, for the lungs yielded it in infinitely smaller quantity.

The fœcal matters contained sulphate of iron.

The vomitings contained sulphate of iron.

The bread and the liquid used as tisane contained sulphate of iron.

This salt had been swallowed during life.

If it was given before the illness of the deceased, it might occasion severe disorder in the economy.

If given during the illness, it might not only aggravate the disorder, but even hasten the death.

In the particular circumstances of the case, it was impossible to determine in what dose, or at what time, the sulphate of iron had been swallowed.

At the trial, long and difficult scientific questions arose; such as—Is sulphate of iron of itself poisonous? At what dose does it become so? Can legal medicine furnish any precise information on the subject? Can we readily distinguish normal iron from iron swallowed? Upon these and a host of other questions, the opinions of several persons, more or less competent, were laid before the court.

The jury, convinced of the poisoning, and considering the character of the prisoner, brought in a verdict of guilty, and sentence of death was recorded; but from the contrariety of opinions given respecting the poisonous qualities of sulphate of iron, and the dose in which it could be considered as such, the court and jury have recommended the woman to government for commutation of sentence.

ON SYRUP OF ACONITE.*

BY M. FERRANT.

This syrup is prepared cold by a simple mixture with tincture of aconite, the richness of which in alcoholic extract being

* *Bulletin de Therapeutique.*

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predetermined, enables us to obtain always an identical product, offering in all cases a combination of conditions never presented by the syrup made with the extract, and for the strongest reasons, the recipe for this same syrup given for 30 grammes by our formularies, that is to say to be made extemporaneously, presenting according to the preceding, an error of excess in the weight of the active matter, of 18 per cent.

Our precaution of first testing the material has not only the advantage of giving more accuracy in the particular case which occupies us, but raises a serious question in pharmacology, that of the variableness of the composition of the more or less aqueous juices and tinctures by simple maceration, all of which contain, as we have often proved, very variable quantities of extract, according to the richness of the primary matter, the temperature of the place and the greater or less completeness of the pressure.

This remark, very important in itself, can alone explain, to cite but one example, the difference observed between the tincture of aconite which is often declared defective and the alcoholic extract generally very efficacious; both prepared with the dry leaf, the alcohol being at the same degree, and administered in corresponding quantities.

I prepare a syrup in 50 grammes of which is a quantity of tincture containing a known proportion of extract, and capable of representing exactly the doses of preparations of aconite habitually given in one day.

The general doses of this syrup, modifiable according to the indications to be followed, are from two to three dessert spoonfuls in the day for adults, and from two to three teaspoonfuls for children. In the particular case of chronic rheumatism, its use will be continued for one or two months, gradually raising the dose from two to six or even to eight spoonfuls in the day.

POISONING WITH OIL OF BITTER ALMONDS.*

On Thursday, July 24th, Mr. William Carter, the Surrey coroner, held an inquest of some hours' duration, at the Queen's Arms Tavern, Spa Road, Bermondsey, on the body of Mrs. Sarah Spencer, aged twenty-six years, the wife of Mr. Spencer, the perruquier and perfumer, of King William Street, City, who died from the effects of prussic acid, at her private residence, No. 4, Spa Road. A great number of witnesses were examined, but the following are the short facts of the case as detailed to the coroner:—Some few weeks since the deceased was confined with her first child, and ever since she had been in an exceedingly low and desponding state, but from what arising no one was able to form the slightest conception. She frequently spoke to her attendants of her unhappy state of mind, and more than once said that she should soon die. She also said that she was not like some other parties, or she would have died some time back (alluding, as the witnesses thought, to her having taken poison on previous occasions). On Monday last she went out and purchased at the shop of Mr. Elkington, the chemist, No. 10, Bamford Lane, Bermondsey, a drachm of the essential oil of bitter almonds and a pennyworth of linseed meal. She made application for a quarter of an ounce, under the pretence of wanting it to scent some pomatum, but Mr. Elkington refused to sell her a larger quantity than one drachm. On leaving the shop, she remarked that it was useless for Mr. Elkington to be so determined, for if she chose she could get a small quantity at each shop in the neighbourhood; and smiling, replied, with all his precautions, he could not bottle up the Thames. She then repaired to her home, and the next morning her husband found her in bed in an insensible state. Dr. Paul, who had attended her in her accouchment, was sent for, and on his arrival found her suffering from the effects of Prussic acid. Everything was done to save her life, but without effect, and she died in less than half-an-hour.—The jury having consulted, returned a verdict of temporary insanity.

* *Observer.*

SOME GERMAN FEBRIFUGE MEDICINES.*

The following formulæ recal to mind the *aloetico-febrifuge elixir* of M. Recamier. (See *Annuaire thérapeutique*, 1850, page 144.)

FEBRIFUGE TINCTURE OF WARBURG.

Under this name a compound preparation is used in Germany, especially in Austria, which has a great reputation as a febrifuge, and of which the composition, according to the works of Pach, Azelt, and Bikert, is as follows:—

* *Buchner's Repertorium*, 1851.

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℞ Hepatic aloes ..... 4 gram.
Zedoary root ..... 4 „
Angelica root ..... 10 centigr.
Camphor..... 10 „
Saffron ..... 15 „
Rectified spirit of wine 100 gram.

Digest, and add to the tincture per 100 grammes,

Sulphate of quinine .... 2 gram.

20 grammes to be taken daily.

FEBRIFUGE TINCTURE OF THE HOSPITAL OF VIENNA.

℞ Aloes ..... 45 gram.
Camphor ..... 6 „
Orange peel ..... 250 „
Helenium root ..... 250 „
Rectified alcohol at 0·830..... 7500 „

Digest for eight days, and add to the expressed liquor:

Sulphate of quinine .... 125 gram.
Sulphuric acid ..... 75 „
Sydenham's laudanum.. 45 „

Add, and filter. The patient is to take 8 grammes of this tincture before the attack.

ON THE COMPARATIVE VALUE OF COCHINEAL, FUMIGATIONS WITH CHERRY-LAUREL WATER, THE USE OF THE VEGETABLE ACIDS, &c., IN THE TREATMENT OF HOOPING-COUGH.*

In an epidemic of hooping-cough, which prevailed during the entire of the spring of 1850, at Candie (Lomelline), Doctor Pavesi instituted a series of comparative experiments on the value of some of the modes of treatment which have been proposed for this disease. Of 122 children who were under his care, he treated forty-eight by the ordinary method, twenty-seven by cochineal, nineteen by fumigations with cherry-laurel water, six by the vegetable acids, and twenty-two by a mixed treatment. By ordinary treatment Signor Pavesi means treatment according to the indications present; and at first view this would not appear to be the most efficacious method, since of forty-eight children he lost ten, of whom six died of cerebral congestion, two of hemoptysis, and one of suffocation. But it is to be observed that, of these forty-eight cases, there were at least thirty-six extremely severe, in which the author could not venture to employ any of the remedies on which he wished to experiment. In these severe cases Signor Pavesi says that he has derived benefit from the application of leeches to the chest and bleedings from the arm, but especially from frictions with tartar emetic ointment and croton oil over the chest, and blisters between the shoulders, kept open for some time. Twenty-seven delicate and intractible children were treated exclusively with cochineal. It is well known that cochineal constitutes a treatment employed from time immemorial in Scotland, and was proposed as a specific by Dr. Wachtt, of Vienna. Signor Pavesi prescribed for his little patients the following mixture; cochineal and carbonate of potassa, of each, eight grains; sugar, one ounce; water, four ounces: mix. A table-spoonful to be taken every two hours. This treatment was employed alone, with the exception of the administration of a purgative when required. The results were satisfactory; not that the disease was arrested in its progress, or even shortened, but the paroxysms were rendered less intense; and whenever the little patients omitted to take their cochineal, the attacks were more frequent and distressing. They all recovered. Nineteen patients were treated by fumigations with cherry-laurel water. The majority of them were strong, and were severely attacked. They were treated in the manner recommended by M. Brofferio, with whom this plan of treatment originated: viz., the head was held some feet above a heated vessel, into which two tablespoonfuls of distilled laurel-water were poured, the mouth being kept open to receive the vapor. These fumigations were repeated every two hours. Relief was quickly obtained, the paroxysms were mitigated, and disappeared almost entirely at night, while they became less frequent and less fatiguing by day. However, the disease was not shortened in duration, nor did Sig. Pavesi ever see it terminate between the sixth and fourteenth day, as M. Brofferio has stated, notwithstanding the pains which he took to remove all external and internal causes capable of prolonging or aggravating the symptoms. One child only was lost from hemoptysis, during a fit of coughing. The vegetable acids were exhibited in six cases only, and with patients who were but slightly affected. They were employed as recommended by Dr. Schmitt, of Hengeraberg, and by Geigel. Tamarinds, vinegar, lemonade (ad libitum), apple-juice with sugar, and syrup of barberries, were given in quantity according to circumstances. The efficacy of this plan was doubtful, and the

* *Giornale dell' Academia Medico-Chirurgica di Turino, and Dublin Quarterly Journal of Medical Science.*

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disease, moreover, lasted six weeks. As to the mixed treatment, it was adopted in cases in which the prolongation of the disease and of its complications rendered it necessary to try different measures. Accordingly, the author lost more patients on this plan than on any other (eight out of twenty-two). In conclusion, the question of the specific treatment of the hooping-cough is not perfectly solved, at least as regards the means employed by Signor Pavesi; for it is surprising that this physician did not think of using bella-donna, the efficacy of which is at least as well established as that of the remedies he has tried. However, cochineal and fumigation with lauro-cerasus appear to be remedies not to be dispised, and the very simplicity of which justifies their employment in many circumstances in which recourse could not be had to more active treatment.

ON THE AMMONIO-CHLORIDE OF MAGNESIUM.*

BY W. S. CLARK.

Chloride of magnesium of itself is not volatile. Hitherto no combination of it with ammonia was known; such a one however exists, and it is volatile. It was obtained in examining the behaviour of ammonical gas towards chloride of magnesium at the fusing point of silver. The chloride of magnesium was placed in a porcelain tray in a porcelain tube; excepting a trace of magnesia, it was wholly volatilized, and condensed in the colder portion of the tube into a white loose powder, which proved to be a compound of chloride of magnesium and ammonia, with the formula $MgCl+2NH_3$, viz.:

	Found.	Calculated.
Magnesium.....	15·85	14.7
Chlorine.....	45·34	43·5
Ammonia.....	38·81	41·7

The want of agreement between the found and the calculated results is owing to the compound undergoing spontaneous decomposition, so that it cannot be weighed without a loss of ammonia. It appears to sublime only in a current of dry ammoniacal gas. Chloride of potassium, treated in the same manner, furnishes no such compound.

Professor Wöhler observes, that magnesium is evidently a volatile metal. When heated in the air, it burns with a white flame like zinc, with formation of white fumes of magnesia.

* Leibig's *Annalen* and *Chemical Gazette.*

PREPARATION OF MERCURIAL OINTMENT.*

BY M. L. FOURNIER.

The following is the process which I have used for ten years in the preparation of the Neapolitan ointment.

Triturate, in an iron or marble mortar, the mercury with one quarter of the grease melted, to which you have added 15 or 20 grammes of white wax per kilogramme; then add, a quarter at a time, the remainder of grease liquid in proportion to the solidifying of the first portions. In the winter the wax may be replaced by an equal quantity of suet. This method succeeds perfectly, and gives a very good preparation in less than an hour.

None of the numerous processes already described resemble this which I propose to you; mine consists more in the manner of operating than in the addition of wax or suet. It is unnecessary for me to explain the advantages of my preparation over those obtained with rancid grease, citron ointment, old Neapolitan ointment, etc.; they must be evident to all.

CASES ILLUSTRATIVE OF THE EFFECTS OF SOLAR AND ARTIFICIAL HEAT.†

BY CHARLES F. MOORE, M.D., L.R.C.S.I., SURGEON OF THE PENINSULAR AND ORIENTAL COMPANY'S STEAM SHIP "RIPON."

A GENTLEMAN, aged about 28, of rather muscular, active make, returning to England after some years' residence in India, embarked in the "Ripon" steam ship, on the 12th August, 1847, then lying in the harbour of Alexandria. Immediately after he came on board, he felt sick and vomited. I may here state that his sickness had nothing to do with sea-sickness, the vessel being perfectly still, and the harbour as smooth as glass. A feeling of drowsiness and exhaustion soon followed the sickness, and in a short time the patient became insensible. On inquiry I found that he had exposed himself much to the sun, and had undergone great bodily fatigue visiting the pyramids, and seeing other sights on his journey from Suez to Alexandria. Having given him some compound spirit of ammonia and tincture of lavender in water, I had him placed in a cool cabin,

* *Repertoire de Pharmacie*, August 1851.

† *Dublin Quarterly Journal of Medical Science.*

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he now roused himself a little, and complained of severe pain at the back of the head, and giddiness; his face and neck looked much congested; the pupils were nearly insensible to light, and half contracted; his abdomen felt full and hard. I gave him five grains of calomel and twelve grains of jalap. A. Farquhar, Esq., of Alexandria, happened to come on board at this time, and concurred with me in attributing the illness of this gentleman to the effects of the sun's rays, so powerful in Egypt at that season. Soon afterwards a purgative enema was administered with good effect. I was now about applying a number of leeches to the patient's temples, when he stretched out his arm wishing to show his desire to be bled. The enema had roused him and brought away a quantity of hard fæces. He endeavoured to express his ideas in words, but only uttered a confused medley of English, German, French, and Italian. I then bled him to a pint and a half, when he became faint, and gradually fell into a sleep, which lasted for some hours. Immediately after the bleeding I gave him a tablespoonful of claret in a little water. On awaking, he expressed the feeling of relief which the copious bleeding had afforded him. His eyes now resumed their natural appearance and sensibility to light, he complained, however of a pain across his forehead, which was much relieved by the application of lint, wet with ether; he had then small doses of blue pill, with extract of hyoscyamus.

August 13th. The pills were continued in small doses; he also had some aperient medicine, and at night a little henbane. In four days he felt well enough to go on shore at Malta without any bad effects following, and continued well during the passage to England.

—— Fox, aged 40, a powerful seaman, about six feet high, complained to me on July 17, 1850, of severe pain in the back of his head, of heaviness, indistinct vision, and a feeling of faintness; his pulse was 58, small; the conjunctival vessels were congested; the pupils slightly dilated, and rather sluggish in contracting on his being placed in bright indirect sun-light. The surface of the body was rather cold. On inquiry, I found that Fox had, on the preceding day, been exposed to the sun for some hours, scraping the ship's topmast, with only a light straw hat on. We were at the time off the coast of Algeria, latitude about 37° N. He was at once bled to twenty ounces, and ordered to take four grains of calomel, and thirty grains each of jalap and tartrate of potassa. A cooling lotion of alcohol and water was applied to his head, and his diet was ordered to be light and farinaceous. Half an hour after the bleeding the pain in the head was somewhat diminished; his pulse rose to 68, and he stated that he felt cooler than before.

July 19. Fox was able to resume duty, and has since continued to enjoy perfect health.

I may here observe, that since about the month of April, last year, 1850, the crews of the Peninsular and Oriental Company's ships are not allowed "grog" as the rum was called it being generally mixed with water, but a small increase in their pay is adopted instead. This plan as far as I can see produced a considerable amendment in general in both the health and comfort of our men. I shall, I hope, in a little time, be able to make more decided statements on this matter.

In connexion with these two cases, which I considered to be samples of coup de soleil, I wish to mention the following attack; induced apparently by exposure to very great heat in the engine-room of the Indus. The temperature of the air in the shade was 84°, while the theremometer (Fahrenheit) indicated 135° in the comparatively speaking cool part of the engine-room. In nearer proximity to the furnaces, independently of the frequent exposure to the radiating heat when the furnace doors were opened the temperature was of course much higher.

On the 31 st July, 1848, I was called to see John Anderson, a powerful man, aged 40, who was "taken with a fit," and fell down while on duty, tending the engine fires. He had been carried on deck insensible, but working in slight convulsions, which did not continue many minutes; his pulse was 130. He was at once bled to eighteen ounces; ether lotion was applied to the temples, and two minims of croton oil were placed on his tongue, and ordered to be repeated, if required, in three hours; he also had two five-grain doses of calomel; an enema of warm water and oil was administered; his head was shaved and blistered, and a sinapism was applied to his stomach. By these active measures his pulse was brought down to 92, and he gradually came round, but continued unable for duty during the rest of the voyage, that is for about three weeks; all that time he had threatenings of a fresh attack in the head, which were apparently kept off by occasional doses of blue pill, renewed blistering, and purgatives.

I have met with other cases which also tend to show that heat, however originated, may produce effects similar to sun-stroke.

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TETANUS TREATED BY CHLOROFORM FRICTIONS.*

BY M. MORISSEAU.

L'Union Médicale states that M. Morisseau, surgeon to the hospital of "La Flèche," succeeded in saving a patient seized with tetanus, by using frictions of chloroform all over the body. M. Morisseau had, in two cases previously treated, tried, in one venesection and opium, and quinine in the other: both had failed; and he had thus been induced to make attempts with chloroform. A few acidulated vapor-baths, and frequent frictions with the anæsthetic agent, brought on recovery in the space of four days.

HERNIA OF THE IRIS; RAPID RETRACTION BY THE USE OF ATROPINE ON BOTH EYES.†

THE *Pheladelphia Medical Examiner* mentions a case of wound of the cornea, under the care of Mr. Morehouse, where the iris were hernitated. Attempts at reduction were made by touching the prolapsed iris with a solution of atropine, (five grains to the ounce of distilled water,) but with little result. Mr. Morehouse then thought of taking advantage of the consentaneous action of the two irides, and applied the solution to both eyes. This method succeeded at once, the iris retreated, and the wound of the cornea soon healed up.

PERUVIAN BARK IN ALGERIA.‡

JESUIT missionaries in Peru have lately sent saplings of the cinchona tree to some of their community who are farming in Algeria, and trials will be made to cultivate the tree in the French colony. Doubts are entertained as to the success of the attempt.

ON THE EXTERNAL USE OF AN AQUEOUS SOLUTION OF TARTAR EMETIC.*

BY DR. C. CLOC.

THE author, in a paper published in the Gazzetta Medica Toscana, reports the effects of the above application in various painful and inflammatory affections, both acute and chronic, as, for example, in acute arthritis, in an inflammatory swelling of the left elbow, in erysipelas of the face supervening during convalescence from small-pox, in metastatic cynanche parotidea, in a leucorrhœa of long standing, which was cured by injections into the vagina of a solution of tartar emetic, &c. It must be observed that the topical use of the remedy was combined with the ordinary atiphlogistic treatment, and with general and local blood-letting. Nevertheless, its effects were rapid and evident. The author draws from his experience the following conclusions:

1. Tartar emetic, dissolved in a large quantity of water, and applied externally as a fomentation, is capable of subduing superficial inflammation, and is preferable to all other local antiphlogisticts.

2. The solution employed by him consisted of ten grains only of tartar emetic in a pound of water, although a greater proportion might be employed.

3. The cloths should be well moistened and frequently changed.

4. As this cannot be done during the night, a small pledget wet with plain water is then to be substituted, so as to dissolve any particles of the salt which may happen to be left on the surface by evaporation.

5. The cloths should be of linen, and they should be folded double.

6. The effects are more rapidly produced if the cuticle be previously removed.

7. If the solution be applied to a blistered surface, a dry, smooth, shining crust is formed, without producing pain to the patient.

8. No inconvenience was produced by the application, even when continued for fifteen days or more, nor did it give rise to any gastro-enteric or general disturbance, whether employed upon the sound skin or over leech-bites, or where the cuticle had been removed.

* Lancet. † Ibid. ‡ Lancet.

* *L'Osservatore Medico di Napoli*, No. VIII. April 15, 1851, *and Dublin Quarterly Journal of Medical Science.*

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